TELEPHONY

Volume XV

The Cum[illegible] Telephone

purchased

Automatic Equipm[illegible]

[illegible]

HARRIS[illegible] and Sp[illegible]

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mode[illegible] me[illegible] ttery AUTO[illegible]IC
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on the su[illegible]'s telephone.

It will re[illegible] individual line,
and private [illegible]change service.

Automat[illegible]lectric Co[illegible]

[illegible]ICAGO

"DIAMOND X"

EXPANSION SHIELD

for

LAG SCREWS

Equal Results at Lower Cost

REDUCES
Original Cost of the Expansion Bolt
Diameter of hole to be drilled
Cost of drilling
Time required to install
Your total cost of making attachment

PATENTED

Oct. 3, 1915 { U. S. Pat. No. 1,155,613 / U. S. Pat. No. 1,155,614 / U. S. Pat. No. 1,155,615

Screw enters shield on center

Screw emerges at side and contacts directly with wall

This new expansion shield is designed for heavy work. Its simplicity, being composed of but one single unit, will recommend it to telephone engineers for construction work requiring attachment of equipment to stone, brick or concrete buildings.

Its principle of operation is the most radical development in expansion bolt design. The screw contacts on one side directly with the hole in the wall. The enormous displacement of metal at the further end is what gives it its powerful expansion at the inner end, where it is most needed.

SEND FOR SAMPLE.

Diamond Expansion Bolt Co.

Manufacturers Diamond Specialties

90 West St., Cor. Cedar, New York

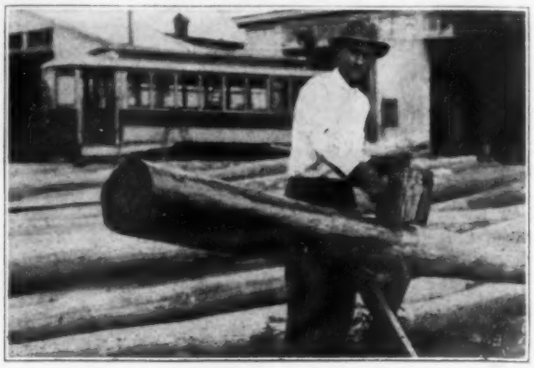
Western Electric Company

INCORPORATED

New York, Buffalo, Newark, Philadelphia, Boston, Pittsburgh, Atlanta, Richmond, Savannah, New Orleans, Birmingham, Cincinnati, Chicago, Milwaukee, Indianapolis, Detroit, Cleveland, Minneapolis, Kansas City, St. Louis, Dallas, Houston, Oklahoma City, St. Paul, Omaha, San Francisco, Oakland, Los Angeles, Seattle, Portland, Denver, Salt Lake City

EQUIPMENT FOR EVERY ELECTRICAL NEED

Member Society for Electrical Development. "Do it Electrically"



Safety First

frequently proves very profitable in the long run. It has paid a great many pole users to use

"C-A-Wood-Preserver"

on poles and cross-arms. **Why should it not do the same for you?**

C-A-Wood-Preserver Company, Inc.

St. Louis and Branches

STANDARD
Telephone Cables

for underground service afford insurance against loss of this kind. We have had 34 years' experience in manufacturing and installing underground cable systems. *Let us give you the benefit of this experience.*

Standard Underground Cable Co.
Pittsburgh, Pa.
Boston Philadelphia Chicago
New York St. Louis
San Francisco

AWARDED PANAMA PACIFIC INTERNATIONAL EXPOSITION GRAND PRIZE

W & M Telegraph and Telephone Wire.

Strand and Pole Steps.

Made by

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VOL. XV CHICAGO, APRIL, 1916 NO. 4

Familiarizing the Public with Long Distance

THE transcontinental line, whose successful completion was the greatest engineering triumph of last year in spite of the more spectacular achievements in wireless, has done more to overcome the public's bashful attitude toward long distance than all the argument and advertising in the world.

Notwithstanding the fact that the commercial interests of the country have not hesitated to keep the toll lines busy for years, we have always maintained that long distance telephony has scarcely scratched the surface of its vast field of usefulness. As a technical achievement it has reached fairly high efficiency, though coming years will bring great improvement, of course. But as a commercial and social utility the long distance line has not begun to measure its possibilities.

The telegraph, indispensable for some purposes, is still used on many occasions when the telephone would be immeasurably better. Where the telegraph is considered inadequate, a step backward to dependence on the mails is more often taken than the step forward to the use of the telephone—even when the loss of time involved is far more expensive than toll charges. Resistance to change must be overcome gradually, and the long distance network is not yet old enough to come unbidden to the average mind even when it is needed.

Cutting in the transcontinental line was naturally a rather dramatic achievement. For the newspapers it had exceptional "story" value—a value so great, indeed, that it still persists after a year of use, which is an extraordinary test in the newspaper world. The result has been a veritable flood of free publicity for the long distance telephone. Its virtues and possibilities have been presented to the fifty million readers of this country by experienced writers who vied with each other for popular interest and literary effect. The same amount of exploitation in paid space would have absorbed an enormous appropriation and been less effective.

The A. T. & T. Company might have been pardoned had it taken advantage of this situation and proceeded to extract from its much praised three thousand mile property all the revenue the traffic would bear. Instead, it chose to take its advantage in a much wiser and broader minded way. Knowing that demonstration is the surest method of establishing interest and creating desire, it has given freely, almost lavishly, of the use of its big investment and operating expense. So many societies, clubs and associations have been entertained by long distance that the number of individuals who can now boast of thousand-mile telephone experiences must be enormous. It is logical to assume that many of these never before used an interstate line.

No doubt these experiences of the A. T. & T. Company's wire guests, regarded almost as adventures, have formed the subject of many a conversation calculated to spread still further the propaganda of toll line use. Within a year almost everybody either has talked two or three thousand miles or has talked with some one who has. Long distance telephony has become a popular topic. And by mental reaction, the use of a one or two or five hundred toll line becomes a mere incident, to be undertaken on the least occasion.

Ultimately the evolution of the transcontinental event should help tremendously in making the ordinary toll lines between allied communities as popular as the mails.

A Merger Not Worth Stopping

MOST if not all the obstacles in the way of Bell acquisition of Chicago's Independent operator have been removed by a kind-hearted city council. Little remains to be done beyond the mere detail of transferring six millions of dollars and taking title to two million dollars' worth of property. The conduct of the Independent property seems always to have been farcical. It has never contributed any glory to the cause of Independent telephony, and its demise will cause little grief.

Ordinarily we are opposed on principle to any and all mergers of Bell and Independent telephone properties. There must be exceptions to all rules and cases where no rules at all apply. This is one of them. The situation is without ethical or moral features.

It is the duty of the Chicago city council and the Illinois State Public Utilities Commission to see that the public does not pay interest on all the money the Bell people are putting up for the merger. We are frank enough to confess our doubts that either of these august bodies will be equal to the task. Ultimately we cannot question that the people will pay. That is a matter, however, in which our only concern is general interest in a question of economics.

It is unfortunate that Chicago, after this experience, is apt to judge Independent operating companies as undesirable, and no doubt it would promptly and vigorously discourage any attempt to secure another competing franchise—at least within the next ten years. That, however, may be a pessimistic viewpoint. City administrations change, and with them the municipal attitude toward many things.

The Chicago Independent has not for years been entitled to the capital I, and we use it here merely as a matter of style. It has been most of the things which an Independent company should not be. The Independents as an organized force will gain by losing it, and we fail to see that its purchaser gets anything.

Mr. Vail Says It Is Still in Force

IN that subdivision of the American Telephone and Telegraph Company's annual report for 1915 entitled "Legal," on page 29, President Vail makes the statement that "The arrangement with the attorney general of the United States, which is set out in detail in the correspondence printed in the report for the year ending December 31, 1913, is still in effect. A careful adherence to it, coupled with entire frankness as to all of the matters in which the company has been concerned, has resulted in a continued avoidance of misunderstandings and disagreements with the federal authorities."

We are glad to see this set forth over Mr. Vail's signature. It is particularly reassuring to observe that the agreement with the attorney general is "still in effect." Some Independent telephone men have seemed to doubt this, and they will share our pleasure in finding their suspicions unfounded. It may be observed, however, that the phrasing of the sentence conveys the inference that it may not always be in effect. That, too, is an interesting surmise, since we had always supposed commitments of this sort were perpetual. No date of expiration was named in this one as we remember it. Indeed, if we mistake not, the agreement used the words "will not hereafter." While that may not mean infinity, except in a theological sense, it is usually accepted as meaning "never again."

Some may be disposed to form the hasty conclusion that the president of the A. T. & T., where he mentions "a careful adherence to it," was stating a hypothetical case. Close study of the paragraph, however, imparts the impression, and even conveys the conviction, that he was wholly serious and in earnest. That his message has been generally accepted in that sense is indicated by sundry scattered newspaper editorials expressing admiration for the legal cleanliness of the big company.

The last lines of the paragraph we quote from the report, however, we believe will be accepted by the Independents without dispute. We are all quite sure there have been no recent disagreements or misunderstandings between the federal authorities and the Bell system. Our friend Terry Allen of Corinth, Miss., among others, is probably already convinced that between the legal department of the A. T. & T. and the legal department of the U. S. A. all is harmony.

Underground Cable Without Conduit

A PAPER by Elmer E. Daicey of South Bend, Ind., which we published last February, has given rise to considerable discussion. Burying lead-covered cables in the street without protection of any kind seems to be a practice more common than is usually admitted.

The only object of this practice, of course, is economy. No one contends that a bare cable in the ground has any advantages over one encased in vitrified clay, fiber or concrete before interment. The question is whether the ultimate cost in service loss and replacement changes is or is not greater than the cost of conduit installation. The experiences of some bold spirits, as related in their letters to TELEPHONE ENGINEER, would seem to indicate that the unprotected cable is satisfactory, and remains so over a long period of years. If there were enough evidence of this sort to establish a scientific rule, we might be in a position to declare that conduit was largely a superstition. But it takes a great many successful examples, without any failures, to assure the absolute safety demanded by "service first."

In the circumstances described by our correspondents we cannot doubt that the system is now, and will remain for many years, satisfactory. Especially in the small city or village, where the exactions of civic development are not so rigorous, a one-horse plow will intrench a cable that will take care of a generation of inhabitants. In such communities the likelihood of disturbance by paving contractors, sewer diggers, water pipe extension bureaus and the like, is quite remote. Municipal progress is even and placid, and increases may be cared for with another trench made by the same plow.

When we grow to permanently paved streets, however, and operating efficiency may depend upon ability to provide accurately for the telephonic growth of fifteen years ahead, conduit becomes an economic necessity. It provides a cable way that is expansible, flexible and independent. New cable may be installed in it, and old cable removed from it without the earth's surface being aware of any change.

The testimony of those operators who have written us on this subject says that cable operates as well, and lasts as long, without conduit as with it. Granting that, we must still regard it as one of the technical conveniences that raise the final percentage of efficiency. A thing need not be absolutely essential to success to be worth its cost.

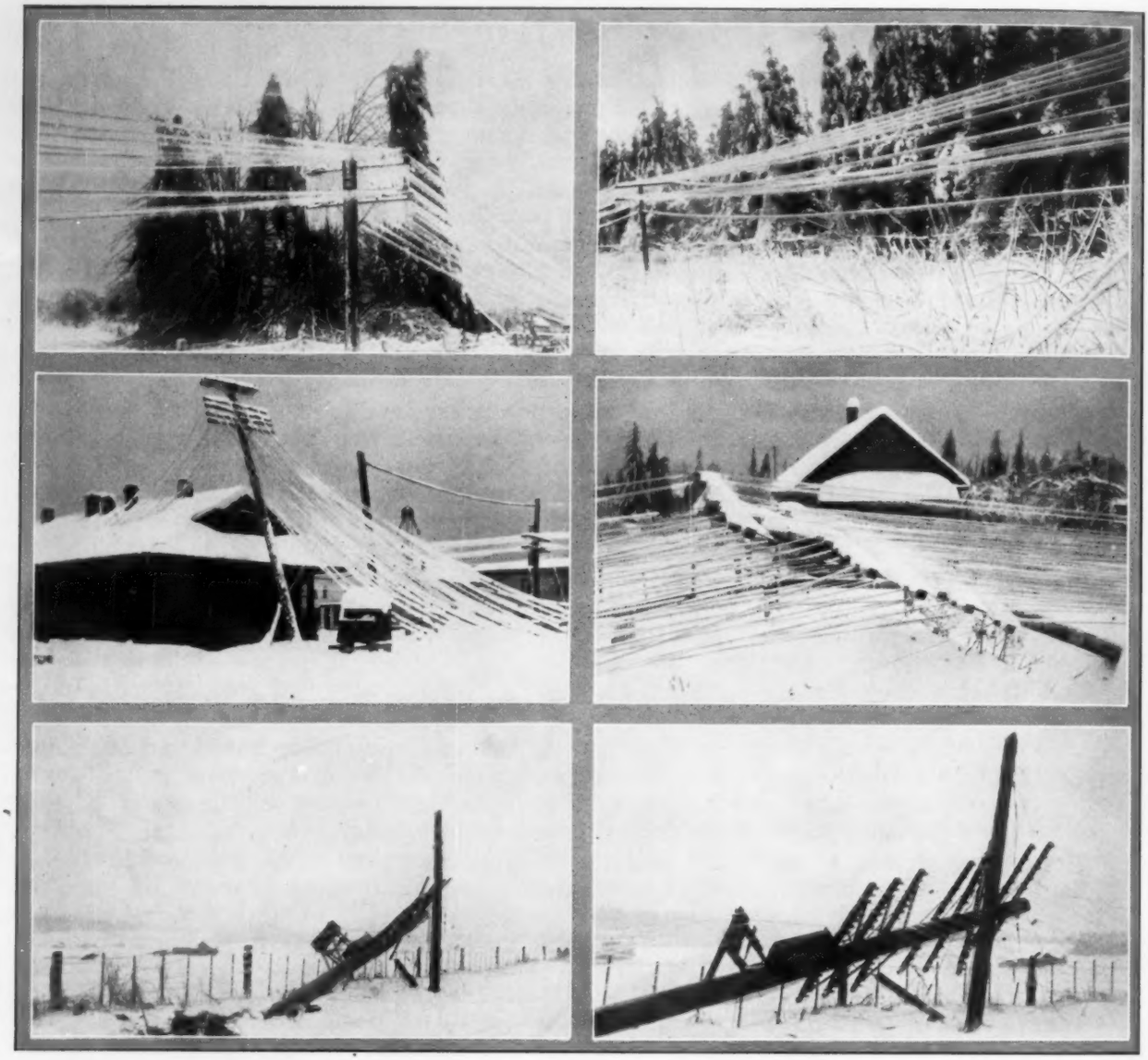
We must conclude that while it is entirely possible to operate efficiently, and to the continued satisfaction of the public, with unprotected subterranean cable, conduit of some sort is still desirable in the finished cable plant that the bigger operators, at least, find essential.

Why a Manufacturers' Association Would Help the Buyer

A WRITER in last month's issue, attempting to show "what is the matter with the telephone business," speaks of the urgent need for a telephone manufacturers' association. We are in hearty accord with this thought. The makers of telephone equipment would be better off if they all were fellow members of an industrial organization. In advancing this as though it were a new idea we do not wish to belittle the work of the existing association which was organized some years ago by Sidney Stein, P. C. Burns and Mayo Lenz, or of previous societies which, so far as we know, never have been officially disbanded. There is need, however, for something more extensive; something that will operate to eliminate those economic extravagances and wastes that result from intense and unregulated competitive methods, and for which the customer inevitably has to pay.

The purchaser is generally suspicious of manufacturers' associations, and perhaps with good reason. Doubtless we shall be criticised for advocating such an organization. It is the popular supposition that when manufacturers affiliate, the screws are tightened and prices and profits rise. But that is not necessarily true.

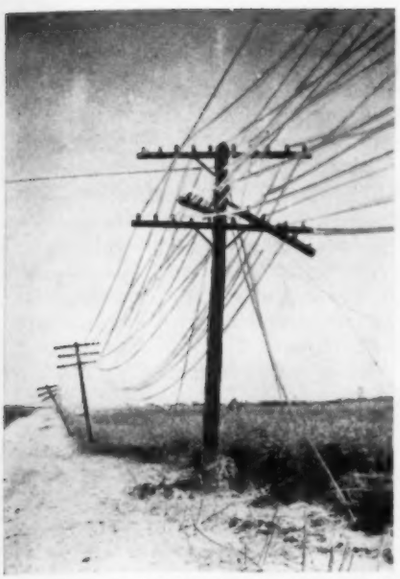
Buyers of exchange equipment have frequently commented on the enormous sales expense attendant on getting their order, most of which is visible to them. When each of five or six manufacturers spends two or three hundred dollars in trying to land a two thousand dollar order, large economic waste is obvious. A well planned association should be able to correct this, to the advantage of the buyer, as well as other faults of the present system.



The silver thaw which did nearly a quarter of a million damage in Portland, Ore., early this spring is shown in views to our readers, through the courtesy of the Journal of Electricity, Power and Gas. The combination of sleet, high winds and freezing temperatures, demoralized telephone and telegraph interests to a considerable extent. The Pacific Telephone and Telegraph Company spent over four hundred dollars a day in housing and feeding employees who were unable to get home, due to interruption of electric light and power, and lack of street car service. As soon as the taxicabs could make any headway additional expenses were incurred in sending the girl employes home in them. It took over 3,000 men three days to even establish intermittent street car service. The telephone company losses, the Home Telephone and Telegraph, Northwestern Long Distance, and the Pacific Telephone and Telegraph Co., suffered nearly $50,000 damages to which the above pictures will eloquently testify.

The strength of the late winter storms in Eastern Missouri is clearly shown by easy manner in which the storms bowled over telephone and telegraph poles and impeded rural road traffic near Sedalia, Mo. The linemen, in desperation to get the lines in operation, utilized any thing that would hold a line, in this case shown, to the right, through the courtesy of the Southwestern Telephone News shows ordinary gate posts in service.

STORIES OF PICTURES OF TELEPHONE PRACTICE AND PROGRESS IN ALL PARTS OF THE WORLD.



Cross arms on Topeka, Kansas, lead snapped like toothpicks under the sleet.

A view of the Scudder Road, the toll lead here tried to get under ground.

This toll lead looks like a weeping willow. Success and Hunt avenues, St. Louis County, Mo.

The storm cuts a few capers near Sedalia, Mo.

Effects of heavy sleet storms in eastern Missouri shown in the Southwestern Telephone News.

The Tri-State Telephone and Telegraph Company hit upon a rather novel advertising feature for use during the recent winter carnival held in St. Paul, Minn., according to the Automatic Telephone in a recent issue. An immense automatic telephone was constructed and used successfully in three parades. The huge instrument is thirteen feet in height. The receiver is nearly seven feet in diameter. The dial is four and one-half feet in diameter and is arranged with a rubber band attachment and bell which permits turning the dial as the telephone proceeds along the avenue. The construction of the novel instrument was left entirely in the hands of Mr. W. S. Williams, St. Paul manager of the Tri-State Telephone Company. After the idea had been suggested and various problems overcome, Mr. Williams put the actual construction work in the hands of a pattern maker. As originally planned the entire instrument was not to weigh more than thirty pounds and was to move along the street propelled by a man who walked inside the main standard. In order to get it any where near in proportion, and strong enough to withstand transporting, the weight ran up to nearly one hundred pounds. Mr. Williams then decided to load it on a decorated bob-sled. Back of the telephone he had a display of telephones, which, with banners in the carnival colors, and several placards, made a most attractive appearance. The big instrument has now been dismantled and stored for future use whenever occasion demands, but the work of changing the entire St. Paul and Minneapolis system of the Tri-State Company from manual to automatic equipment is going right along, and it is expected that the St. Paul exchanges will be cut in service this spring and the Minneapolis system next fall.

We see here what is undoubtedly the highest and yet the lowest telephone pole in the country. It is located at the top of Argentine Pass, and is about two feet in height. The top of the Pass is 13,286 feet. The pole doesn't do much hard work; its chief function is to act as a testing point, and it carries six Chapman arresters. Manager Hancock of Georgetown, the old reliable pack canary, and Lineman Bourne have been making their monthly (and sometimes weekly) trip over the Pass. It is shown here through the kindness of the "Mountain States Monitor."

STORIES OF PICTURES OF TELEPHONE PRACTICE AND PROGRESS IN ALL PARTS OF THE WORLD.

Telephone Is Forty Years Old

It was just forty years ago on March 10, 1876, that the telephone first transmitted intelligible words. The men on both ends of the wire on that important occasion are living. They have seen the great invention spread its way round the world; they have seen the expansion of distance transmission until the American continent was crossed by wires over which San Francisco can talk with New Yorkers. They have seen wireless telephony developed as another wonder of their day.

But no event in their lives will surpass in importance the quiet scene in an attic workshop at 109 Court street, in Boston, when forty years ago Alexander Graham Bell spoke into his mechanism, and his assistant, listening at the other end of the wire in the next room, heard the inventor's voice clearly and distinctly. The listening man was Thomas A. Watson, now a noted ship-builder, who was Bell's aide and confidential assistant in the long, painstaking experiments that had led up to victory.

Mr. Watson has told the story himself.

"I was the only witness to Bell's accomplishment. I heard the first words ever transmitted distinctly over a wire by an electric current. These words were my own name.

"The first time that the telephone ever uttered intelligible words was on March 10, 1876, and it is certainly to be regretted that on so epochal an occasion the instrument was not on dress parade. There is nothing in the history of the telephone to match the famous first message of the Morse telegraph 'What hath God wrought.'

"The first recorded message of the telephone was commonplace in the extreme. It was simply 'Mr. Watson, come here, I want you.' Probably if Mr. Bell at the time had thought that he was making history he would have been better prepared.

"The occasion was merely one of an extensive series of experiments in which some small improvement in the instruments or our increased expertness in using them just made the difference between indistinctness and distinctness.

"After this first communication, the improvement was more rapid, and in the early summer of 1876, it had become possible to converse fluently between two rooms.

"It was my good fortune to have been associated with Mr. Bell during the whole of his famous experiments by which the telephone was developed from the crude and imperfect form into a commercial success. I was employed to embody in practical form his ideas. I assisted in the tests.

"On the afternoon of June 2, 1875, an accidental discovery during our experiments confirmed Mr. Bell's theories that exact sound could be transmitted. Bell's grand idea of a current of electricity which shall vary in intensity as the air varies in density during the production of a sound was nearer practical realization by our heaven-sent accident.

"Mr. Bell, in an endeavor to improve the working of the receivers, was returning one of their springs to ascertain if the pitch was correct. He had pressed it against his ear and was listening to the faint sound of the intermittent current passing through the magnet. All at once the spring of the transmitter in my room stopped vibrating, and I snapped it with my finger to start it. Instantly an excited shout came from the other room, and Mr. Bell rushed in demanding what I had done. I explained, and he asked me to do it again. I snapped the spring the rest of that afternoon and so late in the evening that the janitor, forgetting us, locked us in.

"What happened was this: The spring that I had plucked had become permanently magnetized and was in condition by its vibration to generate the sought-for undulatory electric current. This it did when I snapped it. And when the current passed through the magnet of the receiver which was pressed against Mr. Bell's ear, it set into vibration the spring of that instrument, which spring, being confined against his ear, was in a condition to vibrate as a diaphragm and not merely as a freed reed.

"The trained acoustician at once perceived that he heard loudly and clearly, not merely the pitch due to the length of the spring I was plucking, but the peculiar soft twang of that identical spring, and recognized instantly that the current carrying such a sound was realizing his long-cherished idea.

"He saw that he had here the instrument he had so long sought: That if this apparatus could transmit the quality or timber of one sound it could be made to do the same for any sound or any combination of sounds, and consequently, that most complex vibration—the sound of the human voice.

"But the real invention of the speaking telephone was no accident. That dates from the mental conception of the undulatory electric current. The plucking of the spring that afternoon we may call an accident, but the man with a clear conception in his mind was there to grasp its meaning and turn that accident into a great historical event. Apples fell before Newton was born and cows ate them.

"From that afternoon of June 2, 1875, the goal was in sight. Mr. Bell resigned his teaching position at Boston University, and gave all his attention to his experiment work. Through a long and wearisome course of research, Mr. Bell's enthusiasm never slackened. Finally, on March 10, 1876, he succeeded in transmitting the human voice clearly and thoroughly over the wire.

"The apparatus was ready for a try-out in the following October, and the use of a private telegraph line belonging to the Walworth Manufacturing Company was obtained. This wire ran from their office in Kilby street, Boston, to their factory in Cambridgeport, Mass., across the Charles river, about two miles distant. The evening of October 9, 1876, was chosen for the test. Mr. Bell took charge of the Kilby street end, and I of the Cambridgeport end. On receiving the signal agreed upon through the telephone instrument, I disconnected it from the circuit, and connected the telephone instruments. I listened for Mr. Bell's voice. I could hear only the faintest murmur, reminding me of the first sounds I heard in the early experiments more than a year before then.

"For a while it seemed that we were doomed to failure on this test. As a last resort, I traced the wires, and found a high-resistance telegraph relay in the circuit. I cut this out, ran back to the telephone and listened. That relay had been the sole cause of the trouble. For clearly and distinctly we could talk with perfect ease, although we were two miles apart.

"We wrote down what each one said, and later comparison showed an almost perfect accuracy of transmission. By this means the first conversation ever carried on by a telephone was preserved."

The Keystone Telephone Company reports for February gross earnings of $117,725, or an increase of $9,006 over February, 1915; net earnings of $59,183, an increase of $4,722, and surplus of $31,730, which is an increase of $3,605.

The Annual Report of the Bell System

Abstract of the A. T. & T. Company's Record for the Year

THAT the American Telephone and Telegraph Company and Associated Companies were never as a whole in a more satisfactory position financially, physically and particularly in their mutual relationship with the public is clearly shown in the annual report of President Theodore N. Vail, just issued.

The Bell System now connects 9,151,221 telephones, a gain of half a million stations in the past year. The total wire mileage owned is 18,500,000, of which 10,500,000 is underground. There are nearly 200,000 miles of phantom circuits which carry an overload from the wire circuits, and 8,652,400,000 telephone connections were made during the year.

The revival of general business is reflected by a growth of 225,300 subscribers' stations in the second half of the year, as against 125,900 during the same period in 1914. The Bell System has been able to respond quickly to the demands made because of its policy of providing plant in advance of requirements.

The net permanent capital obligations of the whole system outstanding in the hands of the public is only $736,156,756, although the telephone plants stood on the books on December 31 at $880,068,520 and their appraisal value is over $61,000,000 in excess of the book value. There was $32,863,717 added to plant and real estate last year and it is estimated that $57,000,000 will be spent in plant additions during the current year.

The gross revenue in 1915 of the Bell System, not including the connecting independent companies, was $239,900,000, an increase of over $13,900,000 over last year. Of this, operation consumed $84,500,000; taxes $13,100,000 or 1.64 per cent on the outstanding capital obligations; current maintenance $31,200,000 and provision for depreciation $44,900,000. The surplus available for charges, etc., was $66,200,000, of which $18,100,000 was paid in interest and $32,900,000 was paid in dividends.

During the past eight years the gross earnings have increased $111,300,000, while the assets have increased nearly $445,000,000, with an increase of capital obligations and payables outstanding of only $273,600,000.

As an evidence of the cheapness of telephone service it is shown that net earnings are only 5.84 per cent of the book value and other assets, and that dividends and interest are only 4.76 per cent on the plant and other assets, using in both cases the book value, which is less than the appraisal value.

"The low percentage of earnings on the value of the plant, and the average distribution to capital represented by securities issued against this plant, should convince the most skeptical that under no possible different conditions could the public get cheaper service. Whether they could get better service must be left to the decision of those who have had the opportunity of comparing the service of the Bell System with that of other systems either of this country or of the world."

In the three years, 1913-1915 inclusive, the expenditures from the benefit funds of the Bell companies have aggregated $3,779,896. The reserves for this fund are $9,114,329 and during 1915 the payments for pensions, sickness, accident and death benefits were $1,397,742.

The net earnings of the American Telephone and Telegraph Company for the year were $41,117,487. The interest charges were $6,498,849, and the dividends at the regular rate of 8 per cent per annum were $29,100,591. Of the resulting balance there was carried to reserves $2,500,000 and to surplus $3,018,046.

The number of stockholders, 65,512, not including the 32,000 "employe" shareholders who are paying for stock out of their wages shows an increase of 6,097. The majority of the company's shareholders are women. The financing for 1916 was taken care of by the sale of $50,000,000 4½ per cent coupon notes.

The formal opening of the transcontinental telephone line from Boston to New York on the Atlantic seaboard to San Francisco on the Pacific, on January 25, 1915, has been followed by the extension of "extreme distance" transmission into all the states of the Union and the necessary changes in plant and equipment will be continued to make it possible for any subscriber to talk with any other subscriber regardless of distance. This is being done by smoothing and easing the transmission over the long lines, and therefore necessitates no change in the subscriber's telephone or local line.

By means of radio or wireless telephony the engineering department has during the year greatly extended the area over which the tones of the human voice can be transmitted. Speech has been transmitted by wire from New York to Arlington, Va., and thence by wireless to the radio station at Mare Island, California. By these new wireless improvements speech has also been transmitted by radio telephony from Arlington to the Eiffel Tower in Paris, and simultaneously to the Hawaiian Islands in the Pacific.

On account of the countless variety of materials and the immense number of new parts which are added to the plant of the Bell System each year, there has been, on account of the European war, much difficulty in obtaining many of the supplies needed in manufacture. In every case the derangement of supplies has been but temporary because of the activities of the engineering department in devising substitutes and adopting new methods.

A serious shortage was threatened in the supply of materials needed in the manufacture of the paper used to insulate the wires in telephone cables. Cables valued at from $10,000,000 to $12,000,000 are added to plant each year. The wires of these cables are insulated with strips of paper manufactured from special material. Great lengths of these strips of paper are employed, the amount used in one year being sometimes as much as 2,000,000 miles in length. These cables contain, some of them, as high as 1,200 pairs of wires. It is of the utmost importance to have this paper of the necessary qualities, for upon it depends the life of cable plant of great value. In the paper heretofore employed, all of these qualities were assured by long-continued investigations and abundant practical experience. The sudden adoption of a substitute material might be fraught with great danger of serious failures in the cable plant. A solution of this difficulty was found by the department, whereby the situation caused by the shortage has been met without in any

way impairing the efficiency of the cable plant or increasing its cost.

In the matter of dyestuffs used in insulating materials, chemicals for batteries, and contact materials, similar shortages were encountered and satisfactorily overcome.

In the manufacture of loading coils which are used in long toll wires overhead and underground, great quantities of fine hair-like insulated iron wire of special composition and .004 inch in diameter are employed. Some years as much as 900,000 miles of this wire are used. On account of the congestion of business, and other reasons growing out of the conditions abroad, the supply of this wire has been threatened. This difficulty has been met by the successful development of certain new methods of construction upon which the engineering department has been engaged for a number of years.

The suit of William A. Read & Company (the Central Union case), referred to in the last two preceding reports, has not yet been finally disposed of. It is now being tried in the circuit court of Cook County, Illinois, and it is hoped that a decision in the case will be reached by that court prior to its adjournment for the summer.

The arrangement with the attorney-general of the United States, which is set out in detail in the correspondence printed in the report for the year ending December 31, 1913, is still in effect. A careful adherence to it, coupled with entire frankness as to all of the matters in which the company has been concerned, says the report, has resulted in a continued avoidance of misunderstandings and disagreements with the federal authorities.

During the year the engineering department has done important and confidential work with representatives of both the Army and Navy as to new methods of wire and wireless communication, and it has been made clear that the comprehensive wire network of the Bell plant by a simple plan of co-operation will supply to the scheme of national defense a working system of communication unequalled by that of any other nation.

Mr. Vail says that the relations of the associated companies with the various boards of control and regulations have been most satisfactory, but that the operations of these bodies should be strictly confined to control and regulation and never invade the province of management.

The Bell companies have been foremost to establish and propose to continue their efforts to maintain good wages and good working conditions for their employes, a condition of the utmost importance to efficiency of the service to the public. He shows that since every legal safeguard has been thrown around employes, the combination of employes leading to the suspension of the service and the inconvenience of the public, should not be possible. "Such action on the part of the employes of a 'public utility' is as unjustifiable and unpardonable as would be an arbitrary suspension of service by the utility."

In conclusion he says that the Bell companies have established good relations between their employes and the public, have passed the danger which arose from a promoting speculative boom, and the springing up of unsound duplicating enterprises. Furthermore, the apprehensions that rate-adjusting bodies might bear hard on rates and reduce them to an unprofitable point have not been realized.

Mr. Vail states that, "So long as the policies which now control the companies are followed, so long as there are fair rates and good service there is little danger of public ownership.

"The public is recognizing the fact that in the rates charged for telephone service in the United States there is no exaction, and is beginning to believe that these charges are the cheapest in the world, and the service the best and the total cost to the public is less than it would be under government ownership.

"With a reasonably satisfied public; with a reasonably liberal public; with a reasonably inclined federal, state and municipal control and regulation; without any onerous or unreasonable demands in sight or probable; with a normal business requiring only normal amounts of future capital; with a system sufficiently in advance of existing conditions to meet all possible demands or exigencies; with a business of such a nature that it maks the most economical 'servant' for social or commercial intercourse, the first to be employed, the last to be discharged; with an operating staff from office boy to senior executive, from newest to oldest, who look upon the system as their system, who are jealous of its reputation and zealous in support of it; who have a keen interest in its improvement and development; who believe that their success and the company's success are inseparable, who are never satisfied except with something better and who recognize their obligations to the public—with all these, we should look forward with confidence to the future."

Last Step in New York Merger

Justice George McCann in Supreme Court in Elmira, New York, has granted what is believed the last necessary legal step to effect the consolidation of the York State and the American Telephone Company lines with those of the New York (Bell) Telephone system.

Justice McCann's order makes the Chemung Canal Trust Company of Elmira the trustee for bondholders under various mortgages given a number of years ago by what is now the York State and the American Union Telephone Companies. The mortgages were given by the Elmira Telephone Company and the Binghamton Telephone Company, which were later consolidated as the York State Telephone Company with the American Union as the holding corporation.

The mortgages were given originally to the Binghamton Trust Company which acted as bondholder trustee. The liquidation by the State Banking Department of the affairs of the defunct Binghamton Bank made necessary the granting of the order changing the trustee under the old underlying mortgages.

The merging of the York State Company lines in Binghamton, Johnson City and Endicott will occur March 3, at midnight. An extra large force of linemen of the Bell system is working in the city and two suburbs, placing the Bell Company's wires and cables in shape for the "cutover" which is to mark the inauguration of a single telephone system in this locality.

A rather ambiguous request to the Raleigh (N. C.) chief operator is reported by the *Southern Telephone News*. A woman called and said:

"I heard that you all had three girls to get married last week, and I would like to get a position up there for my daughter."

Telephone Talks

The April, 1916, Installment of an Instructive Serial Course for all Telephone Workers

BY G. W. CUMMINGS AND ARTHUR KNEISEL*

WITH the blowing of the first spring breezes, the thoughts of the telephone man naturally turn toward new construction work. I wonder if the Facility Clerk can tell us something about the first steps taken in assigning facilities on a new order," said the President after the routine business of the Technical Club's meeting had been disposed of.

"I expected that I might be called on to make good the promise you extracted from me several meetings ago so I came prepared to some extent," responded the Facility Clerk. "I will give you a talk on how this work may be done rather than a true account of how we do it.

"When we receive the order with all its copies from the commercial department the number of the order has been assigned. It remains for the assignment division to locate its cable conductors, assign the telephone number and to see that there are sufficient facilities in the way of pin space in case line wire must be put up to reach the station. The assignment division or facility division as it is often called also keeps close tab on cable trouble, arranging for the clearing of any wires which may be open, grounded or crossed, and if the number of open wires exceeds a definite percentage to order a new section cut in in place of the defective one. It must also figuratively keep its finger on the pulse of growth and must notify the engineering department of the need for more cables or poles sufficiently in advance of the actual need for them to enable the latter to make up its estimates and get the construction completed by the time more facilities are required. Our division is really the connecting link between the engineering and construction departments. Consequently a man must have had much construction experience and also have engineering ability in order properly to co-ordinate the work of the two departments.

"The keeping of accurate records is the most important function of the whole work. If a repairman and jumperman change a line from one pair to another or, as happens oftener, a repairman 'temporarily' changes a pair through an aerial cable to clear a case of trouble and fails to notify us of the change, they cause much expense and trouble to the crew that later tries to connect a new line on the stolen pair. I once knew a repairman who refused to do any 'temporary' work even to the extreme of refusing to cut over a line while a bad pair in an aerial cable was being cleared. This man claimed that there is no such thing as 'temporary' work in the telephone field. To him any work done was done until another case of trouble meant additional work. The burden of such extreme measures would no doubt place unnecessary inconvenience upon a subscriber whose line was out of order, but some of our men might profit by this man's teachings. You see, our insisting that we know of every cable change immediately upon its being made is merely a matter of self protection.

"In order to simplify the keeping of records and to have them in such shape that they are readily accessible, the entire territory covered by the exchange system is divided into 'blocks'—usually according to the cable distribution which serves them. In congested districts they are small, sometimes one to a building, and in skyscrapers a 'block' may represent one floor, while in the outlying districts a 'block' may cover several city blocks. These blocks are drawn on cards of sufficient size to show as much information as possible and still are not too large for convenient filing. Six inches by ten inches is a good size. A block card should show the location of every pole, cable box, guy or other equipment required in telephone construction. In order that a block may be located easily, the city territory is divided into districts and these districts are subdivided into blocks which are numbered for speedy location. A key-map of a district is kept displayed to show the relative location of each block. The block map cards are filed with proper index cards to render them easily found. In connection with each block map card are filed the circuit cards of all the lines which terminate in that block. One card giving the telephone numbers of all lines in the block is also with that set of block cards. The cards are all a standard size but may be of different colors for single, two, or four party lines. I have here a model block map card (Fig. 97) and this is a four party circuit card (Fig. 98), and this is a two party card (Fig. 99).

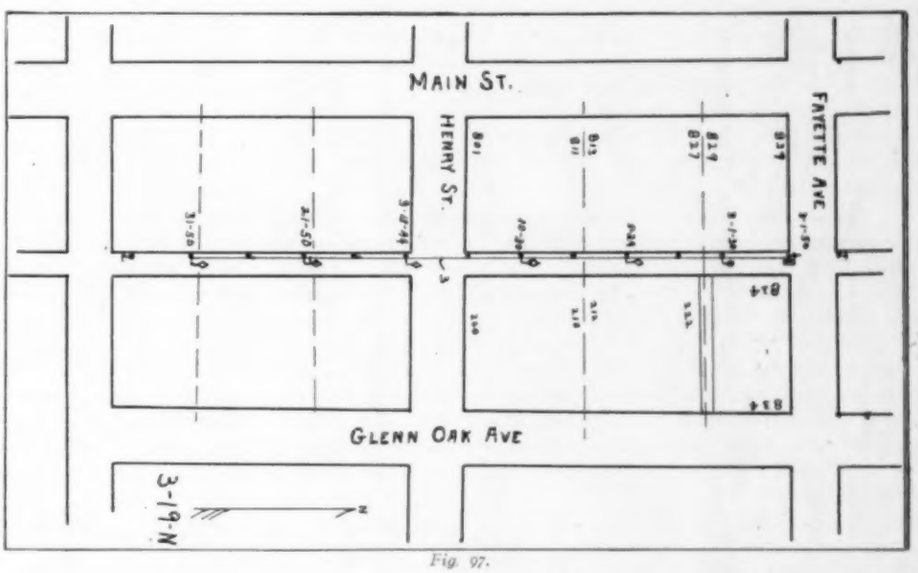


Fig. 97.

"You will note that the block card shows the junction box where the underground cable comes from the exchange and connects to the aerial cable and gives its

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RING	PREFIX	NUMBER	CKT. NO.	CABLE 3-17+20	BLOCK NO. 3-19-N	PLAT NO.	RING	PREFIX	NUMBER	CIRCUIT NOS.			PLAT NO.
1	Main	1021	175	834 Fayette		M							
2	"	4670		216 N. Glen Oak		2							
3	"	3964		208 N Glen Oak	Cut 2-28-14								
4	"	7089		832 Fayette		C							
3	Main	231		214 N Glen Oak		1							

Fig. 98.

numbering. The aerial cable is shown with its multiple taps and the kinds or types of terminals and the block is divided to show just what premises are fed from every terminal. The pairs of the cable are so distributed that the same pairs appear at several cable terminals to permit bridging of party lines at the head. To keep a correct record of the pairs in use and those available for use a record like this (Fig. 100) is convenient. This gives the location of the terminals of the cable and also gives the lines on each pair in use.

"When the assignment division receives the order, the assignment clerk first finds from the address of the subscriber affected the district in which it lies. Then from the district key map he determines the block number and from the block map number what terminal head the line feeds from. If the order is an 'Out' he makes the proper notation on the circuit or line card and if it is the only party on the line working out of one head he erases the number from the cable record thereby releasing the pair in that head for future use. To provide facilities for a party line it is often necessary to change lines about. For instance:

"If conductors 1 to 30 work out of the first aerial head and 15 to 44 work out of the second head, and 21 to 50 work out of the third head, it will be necessary to have two conductors between 21 and 30 clear if the line is a four party circuit having parties feeding out of each of the heads. As the number of subscribers in a block grows the parties on circuits can often be regrouped to advantage so that as many as possible will work out of the same head.

"If all records have been properly kept it is unnecessary for the facility division to send a man out to the field to inspect for facilities but if all the records do not agree or if there is a doubt as to their correctness, a man is sent out to test out and inspect for available facilities. On all 'move' or 'in' orders he enters the new records on his cards."

"Who gives out the telephone numbers to new subscribers?" asked the Installer's Helper.

"The traffic department keeps a record of vacant telephone numbers and supplies us with a list of them; then the assignment division gives them out. Ordinarily a number is not given out if it has been in use until after the issuing of a new directory. So you see we also keep a check on the number of vacant lines in the multiple although the actual checking of the central office facilities is more properly up to the jumper man. We assign the telephone number at the same time we assign the cable conductors or pin numbers if it is to be bridged aerial to another party on a circuit.

"Sometimes a party bridge is made at the protector of another subscriber on the same premises. All necessary information is placed on the orders and it is sent to the installation department and a memo is sent to the instrument delivery department. These two should co-operate to such extent that the instrument is delivered before the installer starts out to run his drop. It is considered more economical to have enough facilities available so that an installer can run the drop and install the instrument too in localities where there is no other line work to do and to have a line crew to put up lines in advance of actual requirements. Where lines must be built to reach a subscriber it is of course advisable to have them run the drop.

"On all new work we endeavor to have a drop run from the cable terminal binding posts all the way through to the subscriber's protector without a splice. We have discontinued the practice of using testing clips which

SERV.	PREFIX	NUMBER	CABLE 3-17+18	BLOCK NO. 3-19-N	PLAT NO.	SERV.	PREFIX	NUMBER		PLAT NO.
2N	Main	789	Bakery 839 Main							
2N	Main	83	835 N Main							

Fig. 99.

puncture the insulation, for such a puncture weakens the insulation because it is rarely taped after the test has been made. Where aerial cable is run into a building it usually terminates in a protector having heat coil and carbon protection and no drop is required."

"How do you know how much cable to put into a district?" asked the Cable-splicer's helper.

"That is figured out by studying the growth of population in the district to be served and particularly by the class of people residing in it and the commercial prospects of the community. Wherever the estimated telephonic growth does not exceed about fifteen suscribers within fifteen years it is considered most economical to install open line wire of bare iron. Bare copper is recommended if the number of lines will not exceed ten in fifteen years. With copper at its present price it should be used sparingly. In recent years we have tried the installation of cable messenger and rings through which we threaded No. 17 twisted pair wire up to eight circuits. When the demand for service becomes greater, the No. 17 twisted pair is taken down and cable is run through the rings. This is being found particularly satisfactory in the suburbs where the demand for telephone service may take a sudden spurt at most any time.

"Our present practice is to install cable as soon as we have more than fifteen circuits in a district fed by open iron wire and also when we have more than ten circuits in a district fed by open copper wire. If the rate of growth in a new district is more than four per year it is wise to specify cable immediately. Otherwise the twisted pair wire may be used until there are about eight circuits. The two factors we must keep in mind is that open wire may be less costly to install than cable, it is liable to call for upkeep charges which make it costly in the end and on the other hand if we install cable which is idle, we have money invested which is bringing in no returns. In smaller exchanges, the commercial department can co-operate with the engineering department to make a special effort to secure a sufficient number of new subscribers to warrant the installation of cable immediately a new district is opened. Theoretically the limit to the number of subscribers in a district is the number of families residing in it. So we must take into consideration the past growth in families rather than in population. I recall an instance where the manager of a company in a town where telephone competition was keen some years ago solicited and secured the subscriptions of a man who spoke Russian only. There were many Russians in one part of the town but at that time it had not occurred to either company that they might use telephones. The result of securing that one subscriber was an addition to the subscription list which upset all previous facility calculations and while the new subscribers were quite a problem to the operating force until the new subscribers learned to give the numbers in near-English, the gain in subscribers was a very considerable factor in the final reckoning of which the company should leave the field to the other when competition was finally ended. So that while the nationality of the inhabitants of a district may have some bearing on the lack of telephone users, it is unwise to overlook them as possible subscribers."

"I have enjoyed the talk this evening," said the President. "As it is still early I will hold the meeting open for discussion. Are there any questions?"

"If iron wire is so much cheaper than copper, why do we consider copper at all?" asked the Contract Agent. As the Facility Clerk had been the speaker of the evening, the question was put to him and he replied: "It is for several reasons.

"In the first place, iron wire has about seven times the resistance of copper. You can talk over a copper line seven times as long as an iron wire having the same cross section. Our radius of speech would be limited very much if we used iron only. We might string a larger iron wire, one having seven times the conductivity, but this would be costly not only for the wire itself but also because it would call for heavier cross arms, poles and other equipment and would be much harder to put into place.

"Then in the second place copper wire has a life far in excess of that of iron. If iron wire were not galvanized or covered with a zinc coating it would rust through in three or four years. Copper wire becomes

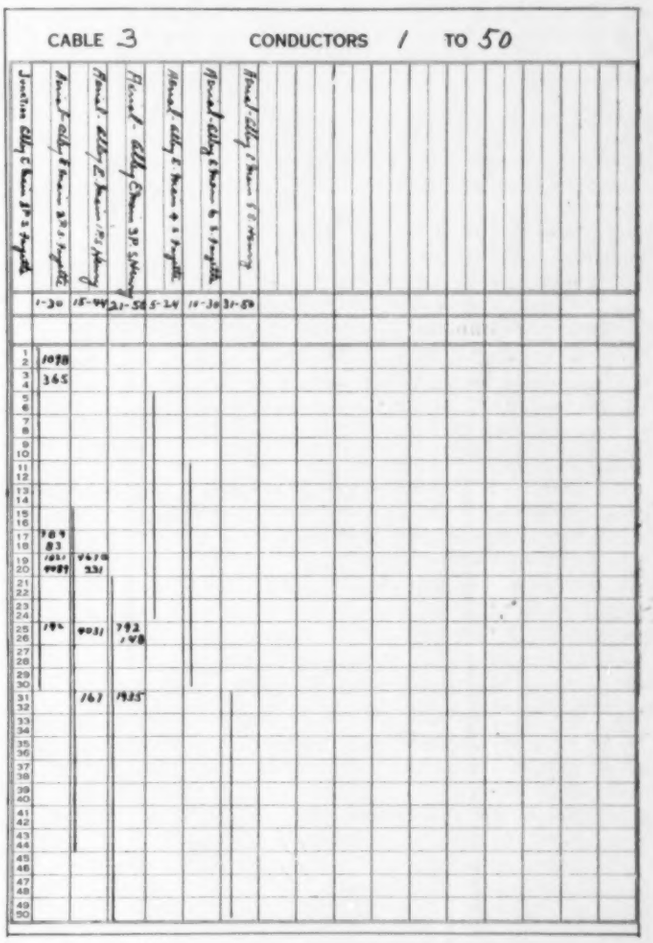


Fig. 100.

coated with a black copper oxide which very effectively protects the inside. I have seen copper wire which had been in use for twenty-five years which was as good for telephone transmission as ever. The hard drawn copper wire which is used today does not stretch as much as the old fashioned soft copper wire and will hold its own for many years. Consequently it is best adapted for lines which are not apt to be reconstructed in more than six or seven years. If a lead is more than 35 poles long it should be built of copper. We seldom have leads of that length in the city."

"What is the advantage of having our underground cable in pipes?" asked the Contract Agent. "I saw an electric light company crew burying a cable in the earth with no protection but a wrapping of something like rope and tape."

"When that cable installed for electric lighting was laid, the engineers had a very definite idea of just how much current it would carry. It is for street lighting and the chances of changes being made in the circuit are not remote. Consequently there is no need of arranging to pull it out and replace it with a larger cable. In telephone work we seldom can afford to install the ultimate capacity cable in a new district. If we lay conduits, we can pull in a 100 pair underground cable first and then as there is call for more cable pairs we can pull this out and put a 200 pair or larger cable in place of it. Usually we install a two-duct conduit immediately when we arrange to put in underground. This allows for growth for some time to come. In congested districts we naturally try to install sufficient ducts to last for as near to the ultimate as we can estimate for the cost tearing up a street to lay additional ducts is very high and the source of great inconvenience to vehicle traffic. Several smaller companies have experimented with the installation of telephone cable without conduit, merely laying the cable in a trench and covering it with a layer of concrete to form a protection against diggers. These experiments have not been under a sufficient number of years to warrant the extensive adoption of this form of construction but there may be a field for this comparatively inexpensive work to lead cables from the main duct run to cable poles inside of blocks—particularly to those located on private property. Buried cable construction is being watched with great interest. Those who have had such construction in place for several years state that it shows no greater percentage of trouble than conduit construction. Its field is probably in the small town where growth is not particularly rapid and where there is not much digging done in changing gas and water pipes. However we do not know everything about the telephone business as yet and the opportunities for making improvements are almost as great as they ever were. So don't be afraid to hand in suggestions."

"We have had quite a long series of these telephone talks," said the President after there seemed to be no further questions under discussion. "Spring will soon be here and then comes the storm season and besides some of us hope to enjoy a vacation later in the summer. In view of the fact that it will be more difficult to gather all of us at every meeting we should consider closing our meetings for the present or until there is a call for 'More Telephone Talks.'"

The Wire Chief requested recognition. "While I realize that we could continue our Telephone Talks indefinitely and never exhaust the subject the truth of your statement is obvious. But in all our talks we have discussed only those things—apparatus, equipment and so forth, which are tangible to us. Would it not be wise to have one of the officials of the company meet with us at a family gathering to give us a talk?"

"Your suggestion is a good one and I will entertain a motion that we invite the General Manager to spend the evening with us at our next meeting and to give us a talk," said the President.

The motion was made and seconded, when the Repairman arose on a point of information. "If we are going to have the G. M. here is he to come here to preach us a sermon or is he to be here as one of us, joining our discussions?"

The President replied, "If he is invited I am sure he will be glad to come as one of the family and have a discussion rather than what you fear may be a sermon, although even that wouldn't hurt some of us."

The motion was put and carried after which the meeting adjourned.

(To be concluded)

Service Helps

The small telephone companies that dot our broad land have found that advertising their service is not as easily carried out as it is commendable. The reasons are obvious and understandable. The small telephone company has neither the facilities nor the time to prepare advertising—advertising that will accomplish its purpose—nor can it afford to establish and maintain an advertising department.

Then again there would be a duplication of effort. An argument for a telephone is just as potent in California as it is in New York State and, therefore, any advertising matter originated by an eastern telephone company could be advantageously used by one in California. Thus may be seen the duplication of effort that would result were each small telephone company to originate advertising matter that would simply be counterparts.

Then again, many small telephone companies have assumed the attitude that advertising is a useless expense, since sooner or later the man who will not have a telephone now will come to the telephone for service. Why spend money in an endeavor to get him to take telephone service prematurely, as it were? The fallacy of this argument is evident. Granting that a potential subscriber will some day take telephone service of his own volition, every year that he has a telephone before the date he himself set for having it represents so much money in the telephone company's treasury. It is evident, therefore, that it is decidedly worth while for the small telephone company to spend money incubating prematurely these embryotic subscribers.

The Western Electric Company has seen the need of intelligent advertising helps for its customers in the telephone field and has thoroughly understood the situation. It has put its advertising department at the telephone companies' service and has created a set of service helps, offered free to any telephone company requesting them, representing a complete and comprehensive plan for selling telephone service.

Another form of service help is the lantern slide used in motion picture theaters. A set of these slides is furnished imprinted with the telephone company's name and address, ready to convince any audience that they cannot get along without telephone service.

Another set of service helps consists of a group of folders imprinted with the telephone company's name and address. These folders have been prepared to be sent to the rural non-subscriber, and the appeal is made with that end in view. The folders are attractive and the arguments convincing. They make splendid ammunition to shoot at the rural list of telephone delinquents.

No telephone company should be without these service helps, just as no telephone company should not have every available subscriber on its lines; very often a simple case of cause and effect. These service helps are "free for the asking" and if any telephone company does not find them adequate they can secure special service and help by writing to the Western Electric Company, who will put its corps of specialists and its advertising department at their disposal.

Bell Mergers "of No Great Importance"

The Department of Justice's Position in Regard to the American Telephone & Telegraph Co.'s Commitment

BY TERRY W. ALLEN

IN TAKING up the question of the violations of the commitment of the American Telephone & Telegraph Company sometime ago, I made the charge in a letter to the Hon. G. Carroll Todd, assistant attorney general, on January 17 that "the Kingsbury agreement has never been lived up to either by the government or the Department of Justice." To this statement the Hon. G. Carroll Todd replied in a letter to F. B. McKinnon, vice-president of the United States Independent Telephone Association, "Mr. Allen's letter also contains the statement that the commitment of the American Telephone & Telegraph Company expressed in its letter to the attorney general, dated December 19, 1913, has never been lived up to either by the government or the Department of Justice. *This statement is not true.*" This very clearly shows to the ordinary man's mind that the Hon. G. C. Todd does consider that the commitment has been lived up to, and that anybody that questions this statement says something that is not true.

With this statement of Mr. Todd before me, I wrote to Hon. John K. Shields, senator from Tennessee, asking him if he would make an investigation into this matter and find out just where I had made a mistake in criticising the government. I stated to Hon. John K. Shields, in my letter to him, "What I was asking was that you simply ask the attorney general for the meaning of these sales. It is my opinion that all of these sales are illegal according to the commitment"; and again, "Mr. Todd states that these sales are not illegal"; and again, "some of us Independent companies in the country do not believe that the Department of Justice is treating us fairly. We would like the Department of Justice to know this through our representatives and there is no other way that I can think of, of appealing or getting the matter before the department."

Evidently in response to this letter, Senator Shields called upon the Department of Justice for an explanation of the matter, and the following letter from the Department of Justice to Senator Shields will prove very interesting reading to the Independent telephone field:

February 18, 1916.

HON. JNO. K. SHIELDS, United States Senate, Washington, D. C.

My dear Senator:—I beg to acknowledge receipt of your letter of the 14th inst., transmitting two letters from Mr. Terry W. Allen, president of the Allen Properties, with chief office at Corinth, Mississippi, in reference to the commitment of the American Telephone & Telegraph Company expressed in its letter to the attorney general, dated December 19, 1913.

I will explain briefly the origin of this commitment in order that you may better understand the situation.

When the present administration came into office it found there were complaints pending in the Department of Justice by the so-called independent telephone companies to the effect that the American Telephone & Telegraph Company and its associated companies, commonly known as the Bell System, were attempting to bring under one control the means of communication by wire throughout the entire country, not only through the expansion and extension of their own system, but by the acquisition of competing lines in violation of the Federal Anti-Trust laws.

The Department investigated these complaints and found that they were not without basis. In July, 1913, a suit was instituted under the Anti-Trust Act at Portland, Oregon, against companies comprising the Bell System and others, charging them with having entered into a combination to monopolize the means of telephonic communication in and between the states of Oregon, Washington and Idaho.

Some time after the institution of this suit the officers and directors of the Bell System indicated that they were desirous of bringing its organization and business throughout the country generally into harmony with the Anti-Trust laws as construed by the Department of Justice, and to that end conferences were had between officers of the Department of Justice and officers of the Bell System. At the same time the views of the principal complainants were sought as to what measures were necessary in order to restore competitive conditions in this field.

In compliance with the suggestions of the attorney general, formulated as a result of these conferences, the Bell System committed itself to the following course of action, briefly stated:

First: It agreed to dispose of its entire holdings of the stock of the Western Union Telegraph Company in such a way that the control and management of the latter would be entirely independent.

Second: It agreed not to make any further acquisitions directly or indirectly, of competing telephone systems.

Third: It agreed not to connect its long distance wires with the local exchanges of independent companies upon the terms and conditions which were outlined.

I enclose herewith a pamphlet which contains this commitment in full, and also Attorney General McReynold's letter of acknowledgment and the President's letter of approval.

This disposition of the complaints against the Bell System met with very general approval at the time.

Mr. Allen, however, disapproved. The following statement from a speech a copy of which he sent to Attorney General McReynolds, disclosses his attitude:

> The question is, why did the government agree to a compromise and why did the government, when it had once started suits upon the Pacific Coast, practically abandon them? I think the secret of this matter is that the A. T. & T. Company has some excellent legal talent that it has used with wonderful effect.
>
> The government, like a hungry fish, swallowed Mr. Kingsbury's bait, hook, line, and pole, and the President and the attorney general both wrote letters and commended the A. T. & T. Company for its magnanimous action.

Mr. Allen has also written many letters on the subject, in some of which quite obviously he has tried to be offensive.

The statement in his letter to you that the Department has permitted the Bell Company to violate its commitment is not true. If there have been any violations of the commitment, the Department has no knowledge of them, and in justice to the Bell Company, I should state that, so far as I can judge, it has shown every disposition to comply fully with the commitment.

There is no question that since the commitment the Bell Company has acquired here and there some independent telephone properties, none of them of any great importance, and that the Department had knowledge of the acquisitions. In fact, the Bell Company itself gave the information and gave it in advance so that if the Department were of the opinion that the acquisitions would violate the commitment, it might object in time to prevent the transaction. The commitment, however, does not forbid all acquisitions by the Bell System, but only acquisitions of competing companies. In none of the cases referred to was there any violation of the commitment. *The property acquired either was not competitive in any real sense* or the acquisition was but an incident of an exchange of properties ordered by the state public service commissions for the purpose of satisfying the just demands of local communities for efficient and economical telephone service.

A typical case was the acquisition by the Bell Company of the property of a small independent company at Clarksville, in your own state of Tennessee. The Clarksville company was in sore financial straits, and the stockholders desired to sell its property and retire from business. They asked the Bell Company to buy. The Bell Company refused to do so without first stating the matter to the Department of Justice and giving it the opportunity to determine whether the purchase would be in violation of the Bell Company's commitment. Mr. Allen protested against the purchase. *The Department made an investigation and ascertained that in no real sense was the Clarksville company a competitor of the Bell Company, and that it was in financial difficulties and could not get the necessary capital to carry on its business and then dispose of its property at a great loss as junk.*

Of course, therefore, the Department took the view that the purchase would not be a violation of the commitment.

I may say, further, that upon being advised that the Bell Company had in contemplation purchasing any property the practice of the Department has been to notify the two principal independent telephone associations (of one of which Mr. Allen was a member and a director) so as to give them an opportunity to state their views to the Department before it too action, AND IN NO CASE THAT I CAN RECALL HAS ANY OBJECTION BEEN OFFERED BY THESE ASSOCIATIONS.

Finally, when I received Mr. Allen's letter of January 18, 1916, in which he stated that the commitment of the Bell Company "has never been lived up to either by the government or the Department of Justice," I immediately, i. e., in a letter dated January 19, 1916, called this statement to the attention of the United States Independent Telephone Association (the two associations mentioned above have now been merged into one) of which Mr. Allen is a director, saying that if the commitment has been violated it has been violated without the knowledge of the Department and requesting that if the Association knows of any instances where it has been violated that it bring them promptly to the attention of the Department. THE ASSOCIATION ACKNOWLEDGED RECEIPT OF MY LETTER BUT AS YET HAS MADE NO CHARGE THAT THE COMMITMENT HAS BEEN VIOLATED IN ANY INSTANCE.

If you wish further information on the subject I will be glad to give it. I herewith return Mr. Allen's two letters to you. I have taken copies of them which, with your permission, I will put in the Department files on the subject. Very truly yours,

G. CARROLL TODD, Assistant to the Attorney General.

This shows that the Department of Justice has allowed the Bell Company to purchase Independent telephone properties *of no great importance*. I emphasize no great importance, because it is what is contained in Mr. Todd's letter. It shows the attitude and mind of the Department of Justice toward Independent telephony, and I thought it wise to give this letter to the public in order that they might see the way they appear in the eyes of the Department of Justice.

I do not feel that any comment upon this letter is necessary. I feel that the facts are so plainly stated that there is no need to call attention to any specific paragraphs in this letter. I feel that it is my duty to acquaint the public with the government's attitude, in order that they may judge for themselves as to the ability displayed by the department and as to whether my statement made to the Hon. G. Carroll Todd, that the commitment has never been lived up to either by the government or the Department of Justice, is true or not. I think that as far as my own position is concerned that this letter to Senator Shields vindicates the position assumed by myself.

Ship's Anchor Breaks 3000 Circuits

About three thousand telephone lines were put out of service March 16 by an accident in the East river, New York, when approximately that number of circuits connecting the boroughs of Manhattan and Brooklyn were damaged by a ship's anchor.

A large emergency force of workmen immediately restored to service approximately one-third of the lines damaged, and in three days a great majority of the lines were in good working order.

Superintendent of Plant Allen explained the accident as follows:

"Seventeen submarine telephone cables running under the East river a short distance south of the Brooklyn Bridge, and providing telephone service between New York and Brooklyn, were torn from their fastenings on the Brooklyn side of the East river by the dragging anchor of the United Fruit Company's steamship Almirante.

"These cables contained more than 3,000 pairs of wires, and all of them were put out of commission. There are 7,300 pairs of wires to Brooklyn from Manhattan carried at four different cable crossings. In reserve there are about five or six hundred pairs of wires which have been brought into service to meet the emergency. Another reserve cable carrying about 300 pairs of wires is now being laid.

"In order to repair the damage it was necessary to put a cable boat into service. The cable boat started at the New York end of the cable crossing and drew the cable up, working along until the breaks were found. There were a few minor breaks in the cable resting on the middle bed of the river, but the principal damage was caused near the Brooklyn side of the crossing."

Los Ange es Regulators Agree

An important agreement, by which it is determined as definitely as possible where the jurisdiction of the city ends in the regulation of public utilities and the jurisdiction of the State Railroad Commission begins, or vice versa, was reached at a meeting of representatives of the commission, the Board of Public Utilities of Los Angeles and of the City Attorney's office held March 17.

While it is naturally left to the Railroad Commission to exercise jurisdiction over the fixing of rates for gas, electric and water utilities, including the payment and repayment of deposits and the installation of meters, the city is to exercise jurisdiction over extensions of service connections, the quality of the commodity served, the efficiency of the service, including inspection of meters, the adjustment of disputed bills and all so-called police regulations.

The city will have practically no jurisdiction over telephone and telegraph utilities, save in regard to what are technically termed police regulations. The Railroad Commission will have complete jurisdiction over these utilities when it comes to rates, service and extensions It was, of course, impossible for the representatives of the city and state to arrive at an ironclad agreement, for, as members of the conference pointed out, if the question of jurisdiction is disputed an appeal can always be taken to the Supreme Court.

The agreement, therefore, is simply a working understanding, by which an effort will be made to apportion distinct and separate powers to the Board of Public Utilities and the State Railroad Commission.

This, it was stated, will also be a guide to the consumer who has a complaint to make. The consumer will know where to go to get redress or to have his troubles adjusted.

Should the consumer, the utility company, the city or the state contest the jurisdiction of either the state or the city body, the Rilroad Commission will make a ruling, and then an appeal can be taken to the Supreme Court.

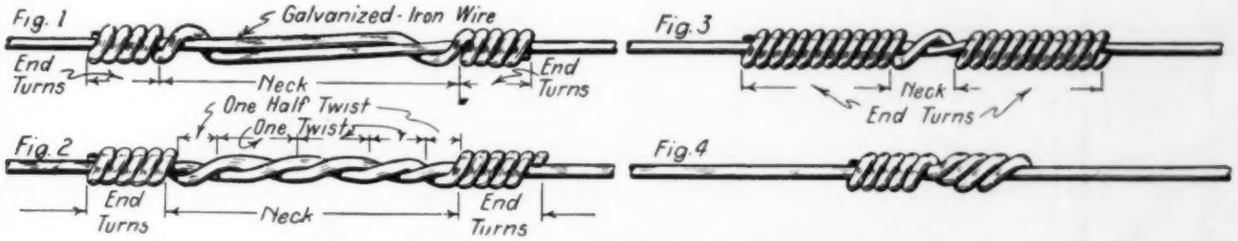
The conference recently held was called for the purpose of settling conflict of jurisdiction that has arisen innumerable times between the State Railroad Commission and the Board of Public Utilities. Present at the meeting were Max Thelen, president of the State Railroad Commission, and Commissioners E. O. Edgerton, Alex. Gordon and Frank Devlin; Fulton Lane, president of the Board of Public Utilities, and F. D. Howell of the board; City Attorney Albert Lee Stephens and Assistant City Attorneys Howard Robertson and Charles Houghton.

The Telephone Scrap Book

Curious and Useful Items, Mostly Telephonic, Gathered from Everywhere

Tests of Splices in Galvanized Wire

THE following paragraphs record the results of a series of tests made by Warren S. Simmons and the writer in the laboratories of Pratt Institute, at Brooklyn, in 1902, while they were students at that institution, says Terrell Croft in *Electrical Review*. The gist of the information thereby obtained appeared in the Pratt Institute "Science and Technology Annual for 1901 and 1902." Extracts from this report have in several instances been printed in the electrical magazines. Inasmuch as requests for additional information regarding these tests have been received, a fairly complete description of the tests made and an outline of the conclusion reached is given herewith.



Examples of Splices Which Will Fail Before the Wire Breaks. Fig. 4 Shows What Results to the Splice Shown in Fig. 2 When Subjected to Tension.

In practical line construction there are several types of twisted wire joints in use, each of which has its advocates. The intention of this investigation was to find, if possible, which of these is the stronger and better, and at the same time to find the dimensions for the most efficient splice for each of the sizes of wire generally used. The joints were tested unsoldered at first, as in many cases it is unprofitable so to treat them, especially where the wire is used only to support a strain, as in guying, where the electrical conductivity is not a factor.

Unfortunately in the laboratory it is impossible to exactly reproduce conditions met with in practice. As a rule when wires are broken out on the line, the rupture is caused by a sudden strain such as a tree falling on the middle of a span or a pole toppling over. In these cases the strain comes so suddenly that probably the wire would break before a joint would have time to untwist, even if the joint were made ever so poorly. It is practically impossible to measure accurately in the laboratory the force of a sudden blow, so the joints could not be tested in this way. But the tests were made on an Olsen testing machine, on which the load steadily increases until the specimen breaks. A machine of this kind reproduces a strain such as a guy wire would be called upon to sustain, or such a one as would be caused by changes of temperature. At any rate, when we have a joint that will sustain as much as the wire itself, we have all that can be desired of it, and the tests were therefore made to find out how the different joints compared in tensile strength with this standard.

In Figs. 1, 2, 3, and 4, are shown some of the types of joints in use. From the illustrations it is evident that there are two components in a twisted joint: *first*, the short turns around the wire at each end, and *second*, the long twists in the middle or the "neck." The effect of each of these was tested separately. No. 12 iron wire, which was found to break at 475 pounds, was used in preliminary tests.

To find the effect of the short turns, the tests shown in Table I were made. The specimens were all wrapped with one twist in the necks and the short turns at the ends were varied as stated in the table. The results shown are the average of several tests for each type of joint. Referring to Table I, in breaking the joints, with three exceptions out of the thirty-five tested, the joints untwisted down to one short wrap before they broke. When a strain is applied to a connection of this type the wires are gradually pulled apart, the length of the joint decreasing, the short turns turning around the main wires as the tension is increased, and usually, if the stresses are continued, the wires will untwist entirely, although in some cases, especially with the large-size wires, they may break when there are but two or three of the short turns left.

From the results it is evident that it would be impossible to make a joint of this type, of reasonable size, the strength of which would even approximately equal that of the wire of which it was made. Also it is apparent that increasing the number of short turns above four or five does not strengthen the splice materially.

To find the effect of the twists in the neck of the joint the tests shown in Table II were made. Specimens for these tests were all wrapped with two short turns at each end, and the twists in the neck were varied as shown in the table. In each case a neck four inches long was used, this being considered the average length used in practice for No. 12 wire, its length being in about the right proportion to this size wire.

Evidently, from the results shown in Table II, a safe joint, that is, one which will hold as much as the wire of which it is made, should have five or six twists in a four-inch neck.

Where four turns or less were used, the joint would start to slip at a load about one-half the breaking load of the wire; would continue to slip at this load or less until it untwisted entirely, or after having pulled down to the

TABLE I. (NO. 12 GALVANIZED IRON WIRE).

No.	*Number of Short Wraps.*	*Breaking Load in Pounds.*
1	3	195
2	3	242
3	4	264
4	6	266
5	8	240
6	10	247

TABLE II. (NO. 12 GALVANIZED IRON WIRE).

No.	*Number of Twists in Neck.*	*Breaking Load in Pounds.*
1	3	230
2	4	230
3	5	475
4	6	475

short wraps it would break. An example of this is Fig. 4, which shows a specimen of a No. 6-wire joint that had four twists in a seven-inch neck before it was placed in the testing machine. At time of breaking these four twists had pulled entirely down to the short wraps. When a wire breaks after having untwisted from a joint such as the one shown in Fig. 4 was originally, the breaking strength is a little over half the breaking strength of the uninjured wire.

The joints shown in Fig. 5 were made in accordance with the above conclusions, and are probably the most efficient joints for the sizes of wire used. As a few short turns at the ends undoubtedly somewhat increase the strength of the splice and add to its appearance, five of them were placed at each end. Judging from results obtained, there is no benefit from increasing this number.

After the above described tests on No. 12 wire were

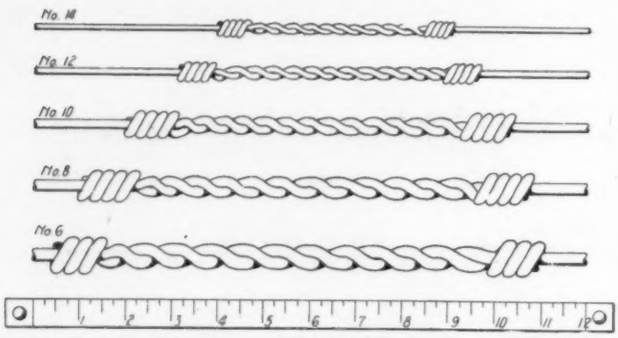


Fig. 5.—Properly Made Joints in Wires of Different Sizes. These Splices All Have Five Twists in Their Necks.

completed, the other sizes, viz.: No. 14, No. 10, No. 8, No. 6, were considered. The object sought in the tests on these sizes was to find the number of twists in the neck of the splice necessary to make it as strong as the wire of which it was composed.

The results for the different sizes of wire were so nearly the same that it does not seem necessary to treat each size separately.

It was found that for all sizes of iron wire tested, in order to make a splice of a strength equal to the wire of which it is made, there should be at least five twists in the neck and about five short turns at each end, although joints made with but two or three short turns at the ends often appear to hold as well as those made with more.

In determining the length which the neck should have there are two things that it seems necessary to consider; if the neck is made too short it will not be possible to make the five turns in it (which judging from results obtained, are necessary) without either "burning" the wire or exercising an unnecessary amount of labor; and secondly, if the neck is made too long, wire will be wasted, and after a certain limit the joint will be weakened. In other words, the proper length of neck is the shortest length that will contain five twists without injuring the wire or making the joint too hard to twist.

The lengths used for joints shown in Fig. 5 are as follows:

No. 14 wire	3.5	inches
No. 12 wire	3.75	inches
No. 10 wire	4	inches
No. 8 wire	6	inches
No. 6 wire	7	inches

To find what effect soldering had on the strength, a few joints were soldered and broken in the testing machine, and it was found that for No. 14 and No. 12 wire even a joint with one twist in neck and one turn at each end would sustain its load, if soldered, while the wire of which it was made would break. On account of lack of time soldered joints of other sizes of wire were not tested.

The splices used were made in the following manner: First, the ends of the wires to be joined were held in the connectors, and with the fingers a length of the wire equal to the length of the neck wanted was given one long twist around the other wire.

Second, the loose end was grasped with the pliers and turned round until the number of twists wished in the neck were formed. Third, the short turns at each end were made.

In making the specimens it was found that unless care was taken to twist the two wires composing the neck equally, more strain would come on one wire than on the other, and the joint would slip or break, whereas if the joint had been properly made with an equal twist in the two wires, the wire itself would break before the splice would give. It was found, however, that when making a splice, if the connectors were held firmly in one hand, and if, while making the twists in the neck with the pliers, they were pulled away from the connectors, putting an equal strain on both wires, the twists could be made to come quite evenly.

Splices of the type shown in Fig. 1 will first pull together as shown in Fig. 3 and then will untwist entirely or break. The joint shown in Fig. 2 is all right as far as it goes, but it will probably stand no more than those of Figs. 1 and 3 because it has not a sufficient number of turns in its neck. The joint shown in Fig. 3 under strain will untwist entirely or break at a comparatively small load after partially untwisting.

Locating Defective Sleeve Connections

IN MAKING tests at various locations recently, it has been found that many of the sleeve connections in copper toll lines are defective, although to all appearances they have been properly made up, says H. I. Birkhead, supervisor of toll lines, in the *Southwestern Telephone News*.

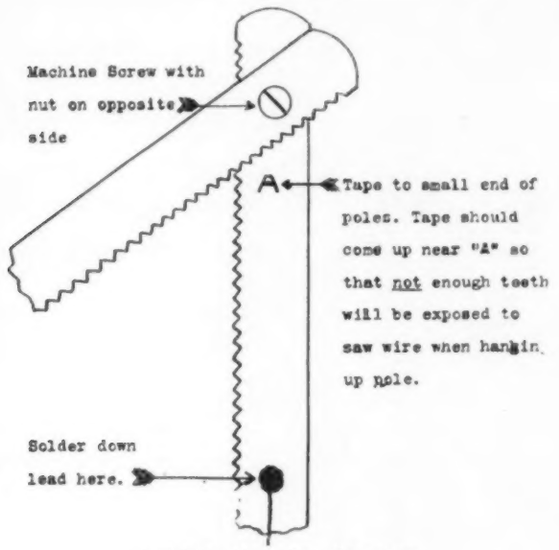
In balancing up several different circuits it was necessary to locate and cut out many sleeves, measuring as low as one-tenth of an ohm. The tests were made with a portable Weston mil-ammeter, reading 0 to 1500.

My method of doing this is to connect a length of line, say six inches, in series with the instrument and one cell of dry battery, noting the reading (this connection should remain only an instant, so that the current will not drop, due to the low shunt on the battery), then connect the same length of line wire, containing the suspected joints in series with instrument and battery, again noting the reading. If there is an appreciable difference in the two readings, provided the contact on the line has been faultless, the joint is removed. Joints removed in this manner have show from one-tenth to several ohms resistance when measured with a bridge and galvanometer.

One dry cell in series with the leads up to the line and instrument will show a reading of from 600 to 1,200 millies, depending upon the resistance of the leads and condition of battery, and since the resistance of the circuit is very low, a fraction of an ohm cut into it will reduce the current reading.

Here is quite a novel and practical method of making connection to the line for these tests that saves much time and labor in covering a stretch of line. Our toll lines are practically all on 25-ft. poles, the highest wires being from 18 ft. to 20 ft. above the ground. Two

15-ft. jointed fishing poles were secured, leads attached to each section and soldered at the brass joints on each end, hack-saw blades were procured, broken in two and fastened together with a machine screw, as illustrated. One of these hooks was secured to the small end of each pole and the lead soldered securely thereto.


Machine Screw with nut on opposite side
A
Tape to small end of poles. Tape should come up near "A" so that not enough teeth will be exposed to saw wire when hanging up pole.
Solder down lead here.

A Quickly Made Test Connector

The sections of the poles are joined together and the instrument and battery are connected to the leads at large end of poles. The poles are then hung over the line wire and by bringing a little downward pressure on the poles a perfect contact is secured. The saw teeth cut through the corrosion without the least injury to the wire.

I have covered 10 wires for 5 miles in a day with this arrangement and located defective joints that it would have been impossible to locate from the testboard, due to their very low resistance.

Transmission Company Avoids Induction

SOME time ago the writer was confronted with the problem of maintaining a satisfactory telephone service over wires strung on poles used for 12 miles of 2200-volt distribution lines, says F. Maury Gillespie in the *Electrical World*. This was accomplished by converting the series instruments in service at the time to bridging apparatus with 1000-ohm ringers, installing suitable carbon spark-gaps and protective fuses at all instruments, and using 1:1 telephone transformers at the most important stations. These transformers were protected by a switch, fuse and lightning arrester supplied by the manufacturer. The wires were transposed at intervals of approximately 600 feet, a high-resistance line wire—No. 12 B. W. G. steel wire—being employed.

Under these conditions service was fair. However, the lines were somewhat noisy under the best of conditions. Grounds on either a power line or its corresponding parallel telephone line rendered the telephones useless until the trouble was removed on account of the excessive humming in the receivers. It was also found that carbon dust would short-circuit or ground a telephone line with the slightest variation from normal operating conditions. While this condition was inconvenient, it did not lead to any serious difficulties, so that no attempt was made to remedy the matter until after a new power plant of 1800-kva. rating was put into operation. This plant is about 10 miles from the point of utilization of power. The transmission voltage is 22,000, energy being transmitted to a step-down station over a double-circuit three-phase line carried on steel poles spaced at intervals approximating 250 feet. The contour of the country is such that spans of 400 to 1,200 feet were possible, and for these spans H frames were used, the same poles being used with the two circuits strung between the two poles, instead of one on a side, as is the case in single-pole construction. Fig. 1 shows the relative positions of the power and telephone wires on this line. Transpositions are at 1,200-foot intervals, and great care was taken to have that part of the line strung to one side of the power lines balance.

On this line the original telephone equipment included the standard 1:1 transformers, insulated for 25,000 volts, with the usual switch, fuse and lightning arrester. When the line voltage reached 15,000 trouble started.

The following were some of the difficulties:

1. Starting or stopping of motors of more than 60 hp. caused the telephone bells to sound.
2. Grounds on either the telephone or power lines rendered the telephone line not only useless but positively dangerous. Even signaling was impossible, as the bells rang continuously as long as the fuses were intact.
3. On very dry days heavy static discharges were noted, generally in the afternoon or early evening.
4. Charging the electrolytic arresters had the same effect that changes of load did; that is, the gongs were caused to ring.
5. The voltage between telephone line and ground was 780, measured by an ordinary switchboard voltmeter connected through a 1000-watt transformer. It is the writer's belief that an electrostatic voltmeter would have given a reading considerably higher than the one obtained.

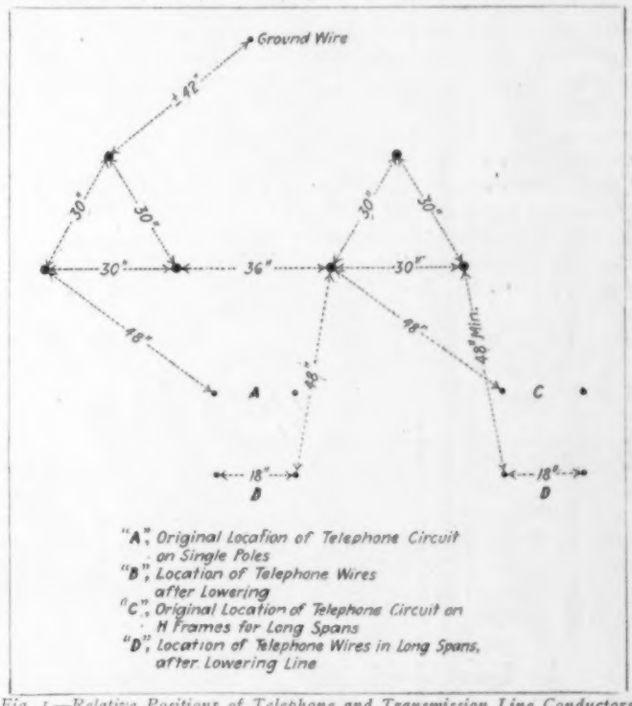


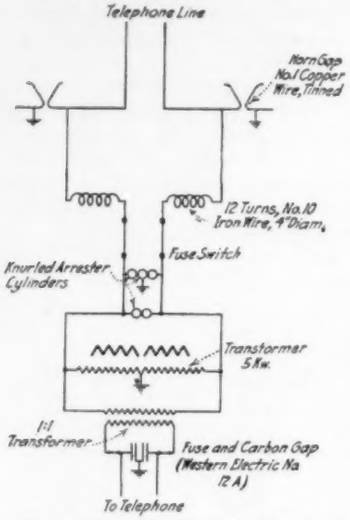
Fig. 1.—Relative Positions of Telephone and Transmission Line Conductors on the Same Poles.

In an attempt to remedy these conditions the telephone line was lowered to give the spacing shown at *B* and *D* in Fig. 1. This caused the following changes in normal conditions:

1. The voltage to ground was reduced to less than 200 volts.
2. Talking was rendered much clearer owing to the reduction of noise in the receivers.

3. Bell ringing due to grounds on telephones and surges in power lines was practically eliminated.

While this arrangement was a great improvement over original conditions, it was still far from perfect. The writer then began to experiment with various types of drainage apparatus, finally adopting as standard the arrangement shown in Fig. 2. This was so satisfactory


Telephone Line
Horn Gap No.1 Copper Wire, Tinned
12 Turns, No.10 Iron Wire, 4" Diam.
Fuse Switch
Knurled Arrester Cylinders
Transformer 5 Kw.
1:1 Transformer
Fuse and Carbon Gap (Western Electric No 12 A)
To Telephone

Transmission line is double circuit, 22,000 volts, 49,000 ft. long. With drainage coils disconnected, the voltage of telephone line to ground with one circuit alive was 70 volts; with both circuits alive, 150 volts. With drainage coils connected all voltage readings are zero. With a horn-gap setting of 0.188-in. the spark-over emf. is 3700 at sixty cycles. With cylinder gap to ground set at 0.063 in. the spark-over emf. is 1200 at sixty cycles. With cylinder gap line-to-line set at 0.01 in. the maximum emf. between lines is 200. The transformer used is rated at 5 kva., 1100-2200 volts primary. The secondary is left open.

Fig. 2.—Telephone-Protection Arrangements Using Drainage Coils for Telephone Line Carried on Steel Poles with a Transmission Line.

that those lines that parallel 2,000-volt lines were similarly equipped.

For telephone lines carried on poles with 2,200-volt power conductors, the horn-gaps shown in Fig. 2 and the choke coils are omitted. A transformer of 1-kva. rating is used instead of a 5-kva. On lines 15,000 feet to 25,000 feet long humming in receivers nearest the drainage coil is entirely eliminated and at the far ends of the lines is barely noticeable.

The writer's arrangement is somewhat different from those employed on the system of the Georgia Railway & Power Company and used by other companies as outlined in various published descriptions, and for this reason it is hoped that it will prove of interest to some readers. The arrangement has afforded relief to the extent that grounds on the telephone line do not render the instruments absolutely useless, as was formerly the case, unless both wires are dead-grounded. Furthermore, the lines can be used even with one or more leaky insulators on the power lines, a condition that was impossible before installing the drainage system. The entire protective outfit—fuses, arresters, insulating transformers and drainage coils—is installed out of doors, and no attempt has been made to protect it from rain, although the precipitation in this locality averages over 100 inches in the six-month rainy season and has reached 40 inches in one month.

An Improvised Military Switch-Board

WE ARE continually having to cudgel our brains here to produce the necessary "straw" for our "bricks," and a short description of a telephone switchboard made from such "straw" may be of interest, says Major G. K. Gregson, R.F.A., in the *Journal of the Royal Artillery*.

The number of lines to the principal observing station of the battery grew fairly quickly to more than we could manage with our available instruments.

A switchboard and exchange became therefore the only possible solution. It was made as follows, vide sketch:

a. Is a strip of metal cut from an 18-pr. cartridge case.

b. Are 5 small metal plates from the same case. The long strip and the small plates are secured to a board by means of screws (*e*) from an 18-pr. cartridge box, and by the terminal *f*.

Holes (*G*) for plugs *C*—the latter being empty .303 cartridge cases—are drilled through metal and board. To prevent these plugs from being lost they are attached by pieces of string to the loops (*h*) of 5 No. 82 fuse pins fixed into the top of the board.

The lines from the 5 stations are each brought through a hole (*i*) in the bottom of the board, and attached to one of the screws (*e*).

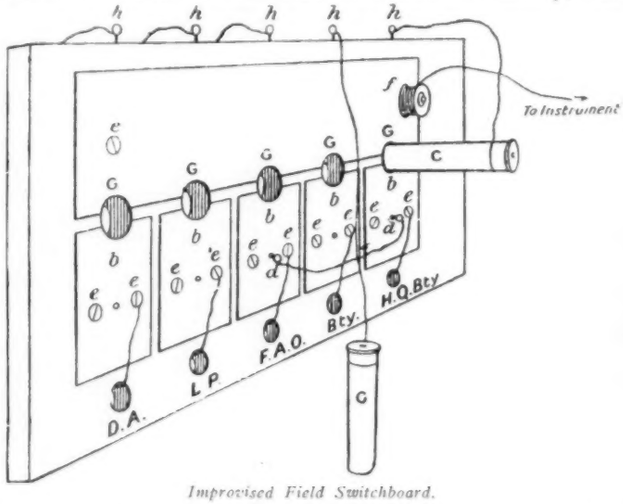
The actual stations connected to the board are:

I. Divisional Artillery Headquarters (D.A.).
II. F.O.O. No. I. (L.P.)
II. F.O.O. No. I. (L.P.)
III. F.O.O. No. II. (F.A.O.)
IV. The Battery.
V. Brigade Headquarters.

It is obvious that any one of the stations can be spoken to, the remainder being cut out for the time being to prevent confusion. Also any one station can speak to another, and it has been found that with an additional circuit made of two fuse pins (*d*) and a short piece of wire, the connection was much improved. Each of the 5 plates (*b*) is bored in the center with a small hole to take these pins.

A line from (*f*) connects to the one instrument. A bayonet (we have plenty of Turkish ones) makes a good earth pin.

The arrangement is specially useful when targets appear in the zones of observation of F.O.O. I, and F.O.O. II, which are invisible from the main observing station. F.O.O. is then connected with the battery, and



Improvised Field Switchboard.

a gun or section placed under his direct control. The battery commander is able at the same time to check F.O.O.'s orders and control the fire.

Four lines connect main observing station with battery. Two are always in use. Both these and one emergency wire are air lines. There is also one buried emergency wire 18" underground all the way. In the heaviest bombardment here we had only 3 of these lines laid and all were cut—two early in the battle, and the third about an hour afterwards. Communication was main-

tained by means of a short buried wire from observing station to a signal station whence orders were sent by lamp during the remainder of the night and by flag when it grew light. The signal station was exposed to a good deal of searching shrapnel and H.E. fire and the signalers displayed much coolness in getting the orders through. Recourse has since been had to this wire on one or two occasions. It is still in existence and forms a third reserve line.

Only one line at present connects each of the other stations to the observing station.

Battery commander's quarters are midway between observing station and battery and both lines in use between these positions are tapped into by short lines communicating with a telephone box near his dug-out. From here by the exchange he is able to speak to any of the stations.

We find the old Stevenson telephone instruments, with which we are provided, double the work and are a constant source of anxiety—as they invariably get out of order at critical moments. My advice is, stick to the "D" III instruments, which we were robbed of at the last moment by fair means or foul.

Proposed Wireless Installation in Spain

Consul Wilbur T. Gracey, Seville, Spain, says that according to information recently published in the official organ of the Seville Chamber of Commerce, a company has been organized with a view to operating wireless-telephone systems in the different cities of Spain and to connect with the Spanish vessels and Spanish colonies in Africa.

The proposal contemplates the erection of stations in this consular district at the cities of Cordoba, Seville, Cadiz, and Huelva, and 29 other stations in other parts of Spain, in the Canary Islands, at Tangier, Melilla, Ceuta, and Ibiza, in Africa. It is hoped that connection can also be made with the vessels plying along the Spanish coast and with the trains, and the system will, if possible, be connected with the regular urban and interurban telephone land lines.

It is stated that a company has been formed at Bilbao to install the lines and stations, and that the Spanish government has been petitioned to authorize the establishment of the system.

School for Telephone Problems

Thirty-six employes of Wisconsin telephone companies are studying telephone apparatus and methods by correspondence through the extension division of the University of Wisconsin. The courses they take discuss the practical problems of the telephone business, and by their aid the men are able to get a more thorough understanding of their work and to improve their chances of advancement.

The Bell Telephone Company has shown considerable interest in the courses, and it is thought that it will make an effort to enroll as many of its men as possible. The supply houses also are interested and some of them have sent handbooks which may be used by students.

At present a reorganization of the courses is under way. The Bell and the Independent companies are supplying all possible information, and a practical line of study is assured. The new courses will be divided into three sections, all or one of which may be taken, and a larger enrollment is expected as a result.

Calls Return of Eight Per Cent Right

That an assured return of 8 per cent on the investment in telephone property would seem to be fair, was a statement made by former Assemblyman E. J. Kneen of La Crosse county before the Wisconsin Telephone Association. Many of those present believed that the rate of return should be higher, in view of the fact that the business is hazardous, but Mr. Kneen backed up his argument with a statement of existing conditions.

"Telephone utilities in this state, since the passage of the nonduplication act, enjoy a very favored position," declared Mr. Kneen. "It is no longer necessary to provide a rate of return based, in part, on the large expense and possible losses involved in competitive public service business. The territory of each company is amply protected by law, and it necessarily follows that the rate of return should be considerably less than when methods of cut throat competition exist.

"The return should be computed upon the true valuation of the property, in which allowance is made for going value and approximately 7 per cent for depreciation. If the utility earnings are in excess of this, such excess should be used promptly in distributing to all classes of service an improvement of the same; or, if the service is exceptionally adequate, in the lowering of the rates to a basis heretofore indicated."

Mr. Kneen dwelt on the need of accurate records, and declared that any effort on the part of owners of telephone companies to demand a rate of return greater than 8 per cent would result ultimately in municipal or government ownership.

"Although it is apparent to all of us that the telephone business, especially for local service, is illy adapted to public ownership, management and control, it might come," declared Mr. Kneen. "Excellence of service, courteous treatment of the public, fair and open financial dealings and satisfaction, with a reasonable and moderate return upon the investment, are the safeguards for the continued private ownership and management of telephone properties."

Bell and Consolidated Connect

An agreement has been made between the Bell Telephone Company of Pennsylvania and the Consolidated Telephone Company, whereby the Consolidated Telephone Company will be given qualified toll line service. The connection will be made on March 21 or shortly thereafter.

All points reached via the lines of the American Telephone and Telegraph Company, irrespective of the distance from Scranton, can be reached by subscribers of the Consolidated Telephone at standard Bell rates. This does not include service to points reached via the lines of the Bell Telephone Company of Pennsylvania within a fifty-mile radius of Scranton. All points on the lines of the Bell Telephone Company of Pennsylvania, beyond the fifty-mile radius, are available to subscribers of the Consolidated Telephone Company at Scranton.

Six Companies Connected

There are six companies whose lines run into Hingham, Wis. The commission issued an order requiring the companies to maintain a central switchboard, so that residents may telephone to one another without having six instruments in each home.

European Telephone Development

Translations from the Foreign Press and Communications from European Engineers

BY FRED W. SCHOLZ

THE present article is to go into the question of the theory underlying the frequency of "busy calls" and the amount of labor wasted at the exchange in answering such a call. There is very little statistical material in this respect and the theoretical discussion has to take its place. The theory of probability has to be used in part for this purpose: If on a subscriber's line a certain number of calls is made, then the line is busy and closed for other calls for the duration of these calls. The ratio of this duration of time to the total time within which conversations can be carried on, gives therefore a probability factor that a line will be found "busy." In mathematics we define as probability the ratio between the number of cases favorable to one event and the number of possible cases. Thus in a chance game with 50 gaining chances and 100 total chances, the probability of gaining something will be $\frac{50}{100} = \frac{1}{2}$. If, therefore, on a subscriber's line during one hour or 60 minutes 1 call is made, and if this call lasts 2 minutes, then the probability that this line will be found busy during the hour will be $\frac{2}{60}$ or 0.033. That is, of 100 calls made within the hour for this line, 3.3 calls are in vain. It is best to work with the hour as a unit, as most traffic statistics are made with the hour as the unit of figuring. Also to take the average duration of a call as 2 minutes corresponds to actual practice.

It is natural and expected that a subscriber on being told that a certain line is busy will call up again. How great is the probability for the fruitlessness of that attempt? Certainly, much smaller. It is only the square of the first probability. If the probability at the first attempt was p, then it is at the second attempt p^2. A third attempt would bring the probability down to p^3, a fourth attempt to p^4, etc. If we wish to be accurate we have to figure with $s = p + p^2 + p^3 + \ldots\ldots p^n$ and $n =$ infinity. The sum of such a geometric ratio, whose final member is infinitely small, is, however, $s = p\ (\frac{p^{n-1}}{p-1})$ $p^n = 0$; $s = \frac{p}{1-p}$. Every call is not so much directed against a certain number but rather against a certain subscriber. If a subscriber has several trunk connections, the busy condition of all the trunks will give different conditions, even if the traffic of that subscriber grows linear with the number of trunks, as if there were only one trunk connection with ordinary traffic. If the subscriber has two trunks, then the probability that both will be found busy will again be a composite one, namely p^2, since the distribution of traffic over both trunks is an arbitrary one. Curve II in Fig. 1 reproduces this case graphically, while curve II*a* reproduces the modification $\frac{p^2}{1-p^2}$ for repeated attempts to call that subscriber.

As a matter of fact the conditions for 2 trunks with greater traffic are in every case more favorable than for one trunk with small traffic. If the one trunk has 4 calls per hour, then the probability for busy line is 0.153 (curve I*a*) and with two trunks and likewise 4 calls each per hour, this probability is 0.018 (curve II*a*) and in the same way the curves III and III*a* show the conditions for three trunks.

The question is now to find the average factors for an entire telephone district. There is no question but that we have to figure with the modified factor $\frac{p}{1-p}$. Another question is how we can include the fact that several subscribers have more than one trunk wire into

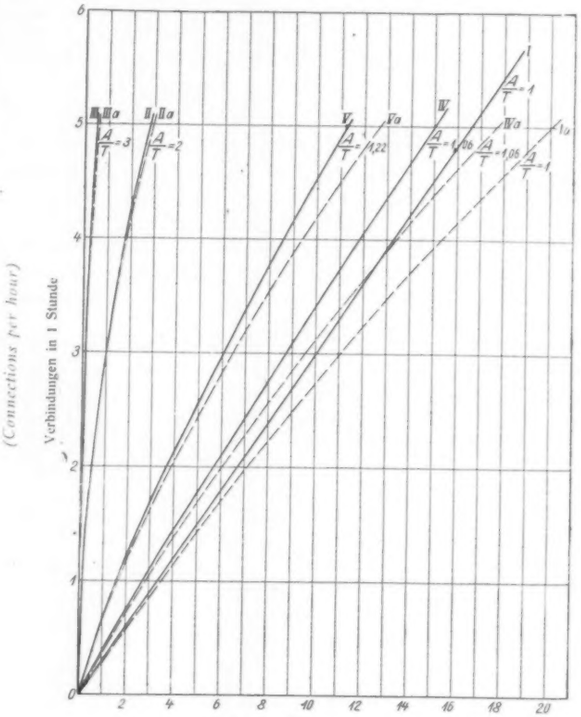


Fig. 1. Probability Curves for Busy Calls.

our computation. Since this is an average computation, the number $\frac{A}{T}$ will be for the average smaller telephone system 1.06. Instead of p we will therefore have to substitute $p^{1.06}$. In Fig. 1 curve IV shows the progress of $p^{1.06}$ and curve IV*a* shows the progress of $\frac{p^{1.06}}{1-p^{1.06}}$. The latter is the right one for the discussion.

It will be advisable to expand this discussion so that it will be applicable also for telephone systems of larger size and extent. For traffic figures, determination of tolls, etc. we usually count only traffic, or calls going out from a trunk line of a subscriber. But in the present discussion we will consider as well the calls received at a trunk line or reaching that same trunk line, since both outgoing and incoming calls make the line a busy one and close it for further calls. If then each trunk has within an hour

on the average 2 outgoing calls, then these 2 calls will have an unfavorable influence leading to a busy condition on some other line. We will therefore have to figure for each trunk 4 connections per hour. This assumption is justified only because we are dealing with average results. With 2 outgoing calls per trunk and per hour, the probability for busy calls will be 0.134 (curve IV*a*) or

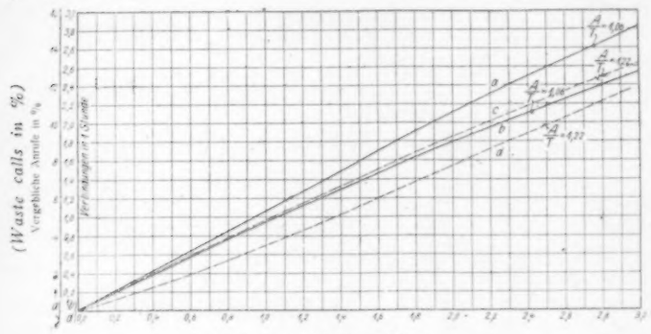


Fig. 2. Calls in 1 Hour.

13.4 per cent. We must go one step further. It is not the finished connection that is looked upon in all such discussions as the standard for outgoing traffic, but the mere fact of calling up, for each such process of calling up has the same meaning for the operator, whether the call is successful in bringing about conversation or not. Consequently in all computations, whether they extend to the technical equipment or to the operator's work, we have the fundamental question: How many calls do we have per day, on the average, per trunk wire? This number must always be on hand and gives the characteristic for telephone traffic. The number of calls is composed of the number of successful calls, equivalent to the connections with conversation, and the number of wasted calls, due to busy wire. For the latter we have a possibility of determining their magnitude. With an average of 2 calls, outgoing, we have 13.4 per cent or $\frac{13,4.2}{100} =$ 0.268 wasted calls, so that in this case the total number of calls is $2 + 0.268 = 2.268$ calls. Curve *b* in Fig. 2 has been figured on this basis.

From this curve we can also read, how many successfully connected calls are distributed over an average number of calls per trunk line. Curve *a* in Fig. 2 is very handy for practice, since it shows how many wasted calls are made per total of calls. This curve is figured in this manner: in 2,268 calls the number of wasted calls is 0,268, consequently in 100 calls it will be $\frac{0.268}{2.268} .100 =$ 11.9.

From these general figures we now come to the application for telephone traffic work with a definite traffic per day. Corresponding to the computations made so far, we have to reduce daily traffic to traffic per hour. This, however, varies with the different hours; it may be within one hour 0.12 of the total daily traffic, at another hour only 0.01 of that traffic. Consequently the factors p will also differ for the various hours. A further differentiation of p may also occur through the varying density of traffic in the exchange.

Curve *a* in Fig. 2 showed how many wasted calls were distributed over a certain number of hours per day. From this it has been estimated, how many wasted calls must be expected for exchanges with traffic conditions of 6 to 24 calls per trunk per hour. These wasted calls have then been compiled by days and figured into percentages for exchanges of various size. Then Table 1 was developed, which shows how many successful connections fall to the various trunks with a definite traffic ratio within the exchange systems of varying sizes. This table can be used with advantage, where the number of calls for a trunk line are known, and where one wishes to draw conclusions as to the really successful conversations, which would be the case in rate problems. Inversely, a second table shows the amount of labor necessary to answer a definite number of calls made by a trunk line.

Table 2, showing the ratio of labor needed per trunk line, can be of value if estimating values and traffic conditions. The intermediate values for 1-4, 6-9, 11-14, etc. calls or connections, can easily be obtained, if one divides the tabular values for 10, 20, 30, 40, etc. by 10 and then adds to the corresponding values of fives, tens, etc.

From these figures we can easily compute what additional staff of operators we need through the wasted calls. The increase in staff corresponds to the percentage

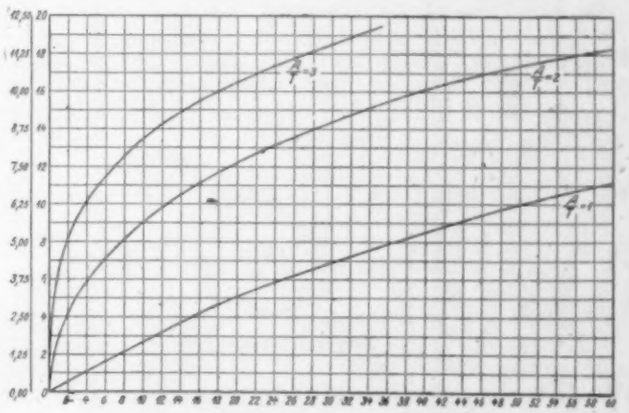


Fig. 3. Probability for Wasted Calls in Hundreds.

basis figured for the entire day. The increase in mechanical equipment corresponds to the percentage of wasted calls during the hour of greatest traffic, since the equipment must answer the demand during this hour but lies waste a great deal of the time when traffic is slack, whereas the operating staff can be adjusted to the hours of

TABLE I. RATIO OF SUCCESSFUL CALLS.

Number of Outgoing Calls from Various Subscribers.	Average No. of Daily Calls per Trunk									
	6	8	10	12	14	16	18	20	22	24
	No. of Connections per Day per Trunk									
5	4.86	4.82	4.77	4.72	4.68	4.63	4.59	4.54	4.50	4.46
10	9.72	9.63	9.54	9.45	9.36	9.27	9.18	9.09	9.00	8.92
15	14.59	14.45	14.31	14.17	14.03	13.90	13.76	13.63	13.50	13.38
20	19.45	19.26	19.08	18.89	18.71	18.53	18.35	18.18	18.00	17.84
25	24.31	24.08	23.85	23.62	23.39	23.16	22.94	22.72	22.50	22.30
30	29.17	28.90	28.62	28.34	28.07	27.80	27.53	27.26	27.00	26.75
35	34.03	33.71	33.39	33.07	32.74	32.43	32.11	31.81	31.50	31.21
40	38.90	38.53	38.16	37.79	37.42	37.06	36.70	36.35	36.00	35.67
45	43.76	43.34	42.93	42.51	42.10	41.69	41.29	40.90	40.50	40.13
50	48.62	48.16	47.70	47.24	46.78	46.33	45.88	45.44	45.00	44.59
55	53.48	52.98	52.47	51.96	51.45	50.96	50.46	49.98	49.50	49.05
60	58.34	57.79	57.24	56.68	56.13	55.59	55.05	54.52	54.00	53.51

TABLE II. RATIO OF LABOR NEEDED PER TRUNK LINE.

No. of Outgoing Calls from Subscribers.	Average No. of Daily Calls per Trunk Line. 6	8	10	12	14	16	18	20	22	24
	No. of Calls to Be Expected Daily per Trunk.									
5	5.14	5.19	5.24	5.29	5.35	5.40	5.45	5.50	5.56	5.61
10	10.28	10.38	10.48	10.58	10.69	10.79	10.90	11.00	11.11	11.21
15	15.42	15.57	15.72	15.87	16.04	16.19	16.35	16.50	16.67	16.82
20	20.56	20.76	20.96	21.16	21.38	21.58	21.80	22.00	22.22	22.42
25	25.70	25.95	26.20	26.45	26.73	26.98	27.25	27.50	27.78	28.03
30	30.84	31.14	31.44	31.74	32.07	32.37	32.70	33.00	33.33	[illegible]
35	35.98	36.33	36.68	37.03	37.42	37.77	38.15	38.50	38.89	[illegible]
40	41.12	41.52	41.92	42.32	42.76	43.16	43.60	44.00	44.44	[illegible]
45	46.26	46.71	47.16	47.61	48.11	48.56	49.05	49.50	50.00	[illegible]
50	51.40	51.90	52.40	52.90	53.45	53.95	54.50	55.00	55.55	56.05
55	56.54	57.09	57.64	58.19	58.80	59.35	59.95	60.50	61.11	61.66
60	61.68	62.28	62.88	63.48	64.14	64.74	65.40	66.00	66.66	67.26

rush and leisure. There is no question that these wasted calls are there to stay, as this lies in the nature of telephone traffic in general, but we are concerned with the problem of reducing their extent. The answer is found in some of the curves in Fig. 1. The number of wasted calls decreases, the smaller the average traffic of a trunk line and the greater the number of trunk lines at the disposal of a subscriber. In the first case the value of the curve lies nearer the zero value, in the second case the curve is steeper. Both points are reached if subscribers are given more trunk connections. The effect of such a system can be made clear from an example. We assume a small erchange with 7,550 subscribers, perhaps 5,000 with contract rates, and 3,000 with flat toll rates. The former have on the average 26 calls, the latter 4.7 calls; the total daily traffic adds up to 130,000+14,000=144,000 calls, and the traffic going out from one trunk is 18 calls on the average. The ratio between $\frac{A}{T}$ or between number of connections A and number of subscribers T was 1.06. Experience shows that the greater amount of traffic falls on a smaller ratio of the contract subscribers, the ratio being usually, that one-quarter of the connections have half the traffic. Then $\frac{5{,}000}{4} = 1{,}250$ contract subscribers would have daily a total of $\frac{130{,}000}{2} = 65{,}000$ calls, or one of these subscribers would have daily $\frac{65{,}000}{1{,}250} = 52$ calls. If we assume that this traffic distributes itself equally over the various connection values and that there are no more than 60 calls, then the daily traffic of the 1,250 connections would vary between 44 and 60 calls. One might determine that subscribers with 44 or more calls per line should take an additional trunk connection, so that 7,550 subscribers would have a total of 8,000 + 1,250 = 9,250 trunks. The ratio of $\frac{A}{T}$ would then be $\frac{9{,}250}{7{,}550} = 1.22$ (formerly 1.06) and the average daily traffic of one trunk would be $\frac{144{,}000}{9{,}250} = 15.6$ calls (formerly 18). For $\frac{A}{T} = 1.22$ curve V in Fig. 1 and curve Va are given. On the basis of the latter the curves c and d have been constructed in Fig. 2, in which c gives the ratio of the wasted calls to the total number of calls in per cent and d gives the ratio of calls to connections per hour. From the curve c for a daily traffic of 15.6 calls per trunk the percentage of the wasted calls for the heaviest traffic hour and for the entire day has been estimated. It is 7.10 per cent for the former and 4.95 per cent for the latter, whereas before the addition of the trunks for subscribers these figures were 11.30 and 8.25 per cent respectively.

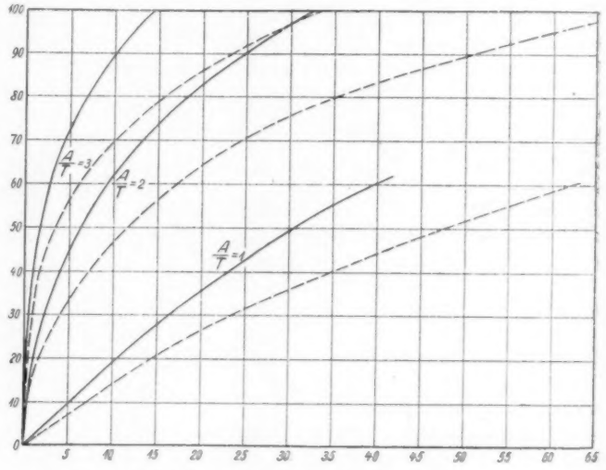


Fig. 4. Wasted Calls in Percentages.

The limit of 44 calls from which limit a subscriber should be asked to add another trunk, was taken arbitrarily previously. We now wish to show how a method of computation may be found to determine this number more correctly. We take the traffic outgoing from one subscriber's trunk wire. If we know the outgoing traffic, we must find some relation for the incoming traffic. The simplest assumption that both are equal is not borne out by facts. As a rule the incoming traffic is much heavier than the outgoing traffic. It has been found from statistics that one can figure the incoming traffic at 1.6 times the outgoing traffic. This has been the basis of the curves in Fig. 3. The three curves have been com-

TABLE III. CHARACTERISTICS OF REPEATING COILS.

Type.	Winding	No. of Windings	D. C. Resistance ohm	Self Inductance coeff. H	Characteristic Z	Capacity W F	Strength of Iron Core in mm.
Bennett	Primary	5200	150	4.20	5060	——	0.7
	Secondary	2x2125	2x150	3.15	4250	0.06	
Siemens & Hulske	Primary	2000	72	0.92	790	——	0.2
	Secondary	2x1400	2x40	1.85	1630	0.003	
Mix & Genet	Primary	1800	150	2.3	2930	——	0.4
	Secondary	2x1250	2x150	4.4	5500	0.0001	
Sedlbauer	Primary	2x1200	2x35	3.2	1450	0.002	0.3
	Secondary	2x1500	2x32	3.8	1780	0.003	

puted similarly to those in *a* in Fig. 1, only with a greater traffic.

They represent the probabilities for finding a line busy during the various hours of traffic, the conditions being $\frac{A}{T} = 1, = 2, = 3$, for the cases that a subscriber has one, two or three trunks. For subscribers with 1 to 3 trunks and daily 1 to 100 outgoing calls, the traffic

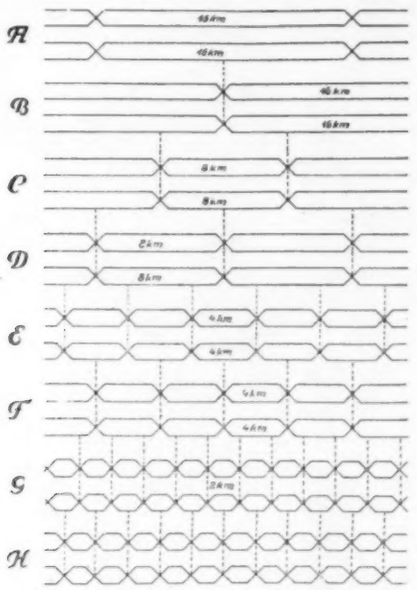


Fig. 5. Transportation of Lines in Bavarian Telephone System.

ratios of the varying hours have been figured and entered in the curves shown in Fig. 3. These percentages added by days have then led to the three curves drawn out in full lines, shown in Fig. 4.

These curves show how many of the total calls directed at a certain subscriber are wasted calls, as his lines are busy, if he has 1 to 3 trunks and from 1 to 100 calls outgoing from them. These curves also give a relative measure of the labor to be done by the exchange in treating these calls. Thus a subscriber with 2 trunks and daily 60 outgoing calls per trunk gives to the exchange wasted labor of 9.3 per cent. The three other curves drawn in broken lines give the same percentages per hour of heaviest traffic, and are, of course, greater. Their meaning would indicate the wasted amount of equipment in the exchange to handle these wasted calls. In the example just given, this addition labor is 17 per cent.

If the curve in Fig. 4 were to be used for determination of rates, an upper limit for wasted call labor would have to be set by the exchange and the subscriber forced to add another trunk, whenever his traffic increases so much, that this wasted labor limit is reached in attending to his telephone traffic. If the limit of 15 per cent were taken, a subscriber with one trunk could have 28 outgoing calls per day per trunk, for two trunks 73, for three 101, etc. This shows that the subscribers with more than 1 trunk offer more favorable conditions than those with but 1 trunk. The ratio, related to 1 trunk, is: 28:2x73:3x101 or 1:5.2:10.8. Another question is, whether the curves taken during the heaviest hour of traffic ought to be included in this computation. This would mean a slight deviation in the limit of permissible traffic. If we take 21.5 per cent, which is the corresponding hour ratio to the day ratio, then we have for 1 trunk a daily traffic of 28 outgoing calls, for 2 trunks 66, for 3 trunks 87.5 or a ratio of 1:4.7:9.4. But it does not seem necessary to include this figure, as the equipment necessary to handle these wasted calls is not as expensive as the operating staff, made necessary by an unusual great number of waste calls. The day curve will therefore be sufficient. Whether the 15 per cent waste call limit is the proper one or whether the limit should be higher or lower, is a question which each exchange will have to decide for itself.—*Telegr. u. Fernsprech. Tech.*

DEVELOPMENT OF BAVARIAN DUPLEX TELEPHONE SYSTEM.

The first attempts at use of duplex, sometimes known as diplex, telephone systems, and later development to use of phantom circuits, was made in Bavaria as far back as 1899. It did not meet with marked success, however, until later, when the policy of transposition of wires became better developed. Fig. 5 shows the plan of transposition of wires followed in this system. The heavier wires, given over to heavy traffic, are placed near the middle of the profile and the smaller traffic lines are grouped around them. The longest four loops are crossed at distances of 9.6 miles; then follow at distances of 4.8 miles the transpositions of four further double lines and then transposition distances of 2.4 and 1.2 miles. If more than 16 loops are carried on one line circuit, then the other transpositions and crossings are built in again at distances of 9.6, 4.8, etc., miles. This arrangement of wires and this plan of transposition has given excellent results and is still used, although being first introduced in 1900. Any two lines transposed diagonally to each other can be used without trouble or without further transpositions as sets of four wires; the damping coefficient of a double line with diagonally arranged branches is, due to the greater opening of the loops, 2

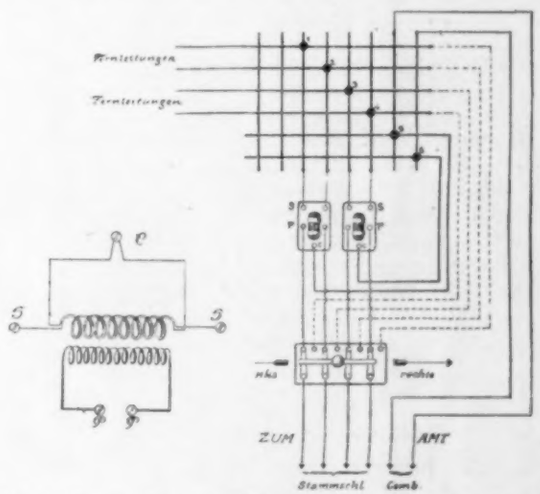


Fig. 6. Bennett Repeater Wiring and Use in Telephone Lines.

to 3 per cent less than in parallel wiring of the lines. Experience has also shown that there is no disturbance between the different neighboring four wires by cross talking or telephone noises.

In spite of the favorable effect in general, it happened frequently that the phantom circuits could not be used simultaneously with the physical circuits as there were troubles of cross talking and of ground noises and buzzing. At times the clearness in conversation suffered so much that communication was impossible. When call-

ing over the phantom circuit, frequently the call signal over the physical circuit was heard and vice versa. These phenomena were noticed only when the end of a physical circuit loop was connected to another longer line or to a grounded subscriber's line without telephone repeaters or without repeating coil. This arrangement disturbed the balance of the system entirely. Finally the Bavarian department of telephones decided to introduce translators or repeaters, which would shut off the physical circuits completely at their ends, so that another line thrown into the system could affect neither the physical nor the phantom circuit. These repeaters are called differential translators and are also known in Europe by the name of "Bennet translators or repeaters." Fig. 6 shows the wiring of the repeater. The iron circuit is formed entirely of wires. The core opening of the wire coil is filled out entirely with 0.7 mm., wire, the ends being bent back over the spool heads and extending over the length of the spool, so that they form a well closed jacket. The electrical characteristics are seen in Table III. In order to obtain a good symmetrical design of the two secondary coils, the wires of these two halves are wound bifilar and connected accordingly at the ends. The symmetry is perfect but the danger of disruption from lightning discharges is immensely increased.

If the phantom circuit is to be cut out, the plugs *1, 2, 3, 4* must be removed from the plug switchboard and the knife switch lever thrown to the right. The use of these repeaters improved service so much that the use of duplex telephony and of phantom circuits increased tremendously between 1902 and 1906.

Of course only small traffic lines were used in this way, as heavy traffic lines gave difficulties in giving the clearing signal and the damping effect in the physical circuits was also increased considerably by using the repeaters. The connection of repeating coils was very disadvantageous for long distance lines whose ends were in the form of cables with fairly heavy conductors. On account of the low characteristic of the heavy wire lines and especially of the telephone cables, the losses when using these repeating coils were very large. Tests made at the time with Mix and Genet repeating coils were unable to remedy matters. The difference between the Bennet and the Mix & Gent repeating coils lies in the divided arrangement of the two secondary coil halves. The latter offers greater safety against lightning discharges but gives no symmetry of the two halves of the coil. A higher damping exponent than B1 = 2.5 to 3.5 could not be reached with any of the coils. The electrical characteristics of this coil can be seen from the table.

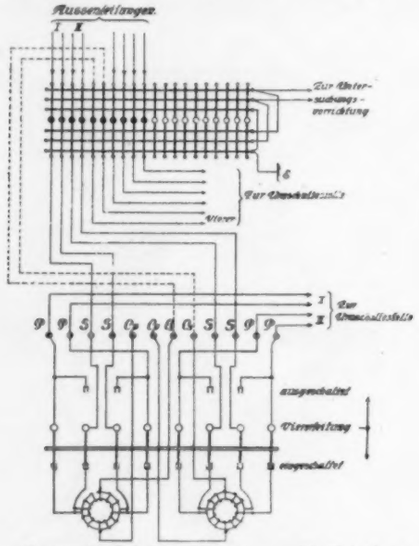


Fig. 7. Connection of Ring Repeaters with Telephone Lines.

However, the complaints concerning poor service did not end and the department finally gave orders that for long distance traffic only the ordinary double lines or the four lines should be used and the physical circuits of the combination lines should be used only for city traffic. These requirements made operation very difficult, and at times even impossible. The four-line circuits were useful for short distance communication but useless for longer distances. Finally the testing department of the Bavarian telegraph and telephone department took up the question and attempted to build a repeater which would meet all demands. The use of a completely iron-enclosed magnetic circuit arrangement seemed to offer the only solution. The disadvantages of older systems could now be eliminated by proper construction. An iron core of proper form with a better arrangement of windings was designed. The coils designed were called from their shape "ring repeating coils" and were made by the Siemens and Halske company. The new repeater differs from the others through the low values of the d.c. resistance, of the self-induction coefficient and especially of the characteristic of the two coils. Experiments made with lines of 180 miles length gave such good results that the new repeaters were introduced not only in all new lines to be built but also in place of the old Bennet repeating coils. A set of two coils is fastened to a wooden stand, as Fig. 8 shows. Connecting and disconnecting is done by means of a knife switch. The same figure also shows the winding of the coil. For the sake of clearness the primary and secondary coils are shown lying next to each other; in reality, the primary coil lies over the secondary coil. Both of the coils are branched off at the center. The two coil halves formed by this division are not bifilar, however, but attached to the iron core in the following manner: First the ring is divided exactly into halves by two insulating pieces. On each half, windings of 750 turns are placed and these windings covered with insulating tape and over this another set of 750 windings wound. Then the inner coil of the first ring half is connected with the outer coil of the second half and the inner coil of the second half with the outer coil of the first half. The secondary coil is then completed. The primary coil is wound in a similar fashion. By this means great symmetry of the central divisions can

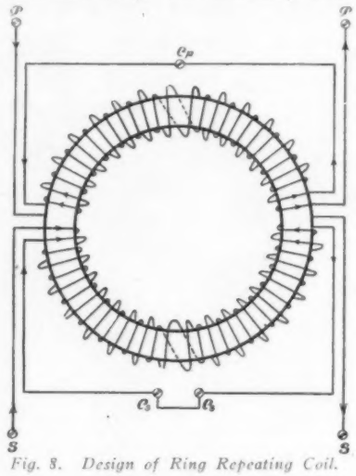


Fig. 8. Design of Ring Repeating Coil.

be obtained without necessitating the adoption of the faulty bifilar winding. These repeaters excel by their disruptive strength against lightning discharges and since their introduction in 1908 not a single coil had to be exchanged. These coils are now made by the Sedlbauer company in Munich. Fig. 7 shows the connection of these coils with the telephone lines.

In these later coils the number of turns of wire has been increased and the strength of the iron core has been raised so that self induction coefficient and characteristic are raised giving an even better telephone line.—*Telegr. u. Fernsprech Tech.*

ERICSSON WIRING FOR SMALL TELEPHONE EXCHANGES.

The numerous advantages of the common battery system make it seem advisable to use it even in very small exchanges, such as rural exchanges. The cost of equipment can then be reduced by saving in relays or by using smaller relays. The following gives an idea of the Ericsson system, built in Stockholm, Sweden, in which the characteristic arrangement of the system, feeding by way of the calling relay is maintained, the cut-off relay replaced, however, by jack interruption. Fig. 9 shows the wiring for this system.

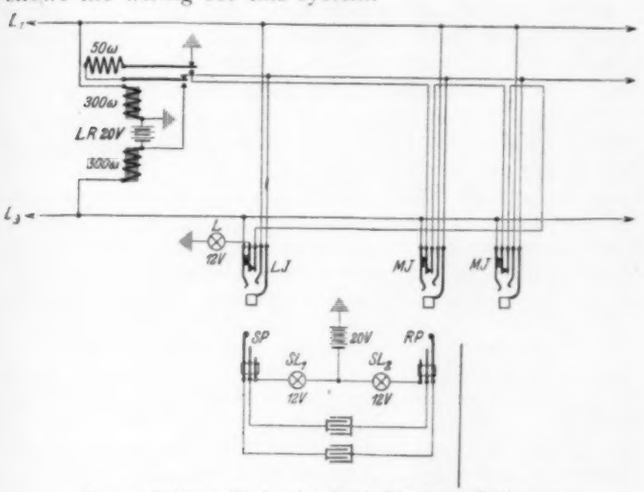


Fig. 9. Ericsson Wiring for Small Telephone Exchanges.

When calling a subscriber, the current circuit L_1, L is closed, the line relay LR receives current and attracts its armature. The call lamp L receives current from the negative pole of the battery through the 50 ohm resistance of the line relay, by way of the connecting jack MJ and the interrupter contact LJ. By introducing the inquiry plug SP the current connection to the calling lamp is interrupted, and the lamp goes out. After the operator has found out in the usual manner whether the line is open, she places the connecting plug RP into the proper jack, whereupon the signal lamp SL_2 lights up and shows that the connection has been made. When the called subscriber lifts his receiver, his line relay receives current, attracts the armature, thereby cutting off current to the lamp SL_2. After finishing the conversation, the receiver is hung up again, the line relays return to the rest position and the closing lamps SL_1 and SL_2 receive current by way of the 50 ohm resistances of the corresponding line relays and the connection is broken.—*Elektroteknisk Tidsskrift.*

ITEMS OF GENERAL TELEPHONE INTEREST.

Glass Telephone Poles: German telepgrah and telephone departments have recently completed experiments with glass telephone poles. They are given the necessary strength by having the glass poured around a central network of steel wires. Such glass poles are said to be much more durable than wooden or iron poles as they are not attacked by insects or by the moisture in the soil and do not corrode.

Telephone Equipment on the Vienna-Pressburg Railway: The great speed on this single track line, and also the dense traffic and the high tension current used, which is for the greater part of the line 16,500 volts single phase current, made the railway department pay careful attention to the telegraph and especially the telephone equipment of the road. At first it was decided to lay the telephone lines away from the roadbed on private ground, but this plan had to be dropped owing to high cost. The wooden poles running parallel to the tracks carry two 3 mm. iron wire lines for the telegraph work and four bronze wires for the telephone work. Two wires of the latter are used for communication between stations, the two others are used for general telephone traffic and for the crossing guards. The telephones at the stations can be connected by line selectors either to the operating line or to the telephone lines connecting with the crossing guards. All the instruments are of the type safe against high tension currents. At first much difficulty was experienced with the telephone transmission when the railway was in operation. The static charge of the line reached as high as 2,000 volts. The insulation of the equipment and the ringing bell circuits were not strong enough for this charge and gave trouble. Then the insulation was completely changed and no further trouble was experienced. This is all the more remarkable, since the lines run for a distance of 30 miles parallel to the high tension lines and the distance between feed wires and telephone wires is often as little as 4 feet. This result was obtained with very simple means, without the use of grounding coils, condensers or other apparatus requiring special care. Great care was lavished on the transposition of the two wires of a loop and also on the faultless property of the insulating material. The two wires of a loop are mounted on a horizontal arm and not at an angle of 45 degrees as is often recommended. Disturbances in the state owned systems have not been noticed either, due partly to the excellent return circuit through the rails. For protection against lightning discharges the tops of the poles are connected with the poles by a 25 sq. mm. copper coil; all poles are connected by conductors with the rails and these in their turn are grounded at frequent points with underground waters. The second rail is connected with the first rail at distances of 3,000 to 6,000 feet by diagonal connections.

Zinc as Open Wire Material: The scarcity of the copper supply in the Central Empires has brought forth a great deal of new light on the use of iron or zinc for line material to take the place of the precious copper. Material of equal value as copper is not at hand, since the supplies of copper have been requisitioned by the authorities, for aluminum shares the same treatment as copper. At first it was tried to go back to the original iron wires for line material, but this was soon abandoned, as among other disadvantages iron has 7 times as small a conductivity as copper. Zinc, however, has not been requisitioned and large quantities of this metal are at disposal. Zinc in its ordinary form cannot be used for line material; it needs careful refining. But even the refined metal cannot be drawn out to thin wires. It can only be drawn out when in a hot state. There are very narrow limits for this heated state and the zinc can not be drawn beyond a certain temperature and must stay quite near the limit below the proper temperature. This

is to be obtained by having the zinc run through melted paraffine. The cooling of the drawn wires must go on slowly, as sudden cooling makes the wire lose its homogeneous structure and makes it brittle. The lack of uniformity in the drawn out wire makes it very difficult to use zinc for open wires. Frequently it has been found that next to uniform places in wire there were brittle places. Higher degrees of heat as used for vulcanizing of rubber and for drying and saturating of fiber insulated cables cannot be applied to zinc. It also stands cold weather very poorly. It has been seen that zinc wire exposed to the open air during a cold winter's night showed an almost glasslike brittleness during the following few days, which did not decrease with higher temperature, either. Zinc wire is also injured by heating caused by passing of current. By utilizing the experiences found so far, the wire and cable industry hopes to produce zinc material which will to some extent meet the demands of the electrical industry, but it is doubtful whether zinc can maintain its stand as a metal for electric wires, after the war is over and imports of copper start again.

A concession for the installation of a new public telephone service at Buenos Ayres, Argentina, has been granted by the Municipal Commission of the city to Senor Alex. Schwimmer. The system is intended to provide news and electrophone service, and the concession lasts 30 or 50 years; the concessionaire will pay 6 per cent of his gross receipts during 30 years, and 12 per cent during the remainder of the term, to the municipality, with a fixed minimum annual payment of 50,000 Mexican dollars, and the maximum price per subscriber's station is fixed at $10 per month.

Cross Country Line Growing Popular

Californians have discovered a new powerful ally in the transcontinental telephone.

Over the long line Californians, San Franciscans especially, are telling hundreds of thousands of easterners "some wonderful things about California."

Since the installation of the transcontinental telephone service between the east and the west banquets or gatherings of importance held simultaneously in New York and San Francisco have not been considered complete as to detail unless the two assemblages were connected by telephone wires.

Guests at banquets in New York and other large eastern cities have come to expect that they will be able to sit down at the festive board, take up a telephone and listen to the waves lapping at the Golden Gate.

As an example of the variety of service being transacted over the transcontinental line the company has for illustration the joint meeting of the Engineering Clubs of San Francisco and Boston in which almost a thousand people took part and listened to a dozen speakers on technical subjects, the joint banquet between the California and New York Academy of Sciences, the installation ceremonies held recently at Stanford University, which were listened to by the Stanford members in New York; joint meetings of various Rotary Clubs, chambers of commerce and boards of trade, the meeting of the Lake Carriers' Association of Chicago, which was addressed by Captain Robert Dollar from his Marin county home, and the arrangement of racing schedules between New York yachting clubs and San Francisco yachtsmen, in addition to large number of individual business and private calls.

Since the inauguration of the transcontinental service between San Francisco and eastern points more than 220,000 persons have talked or listened to conversations and demonstrations over the line, according to estimates of Pacific Telephone and Telegraph officials.

Another Selecting Device

Laboratory tests of F. E. Granger's new telephone selecting device present a new type of farm line telephone.

This telephone is different from anything yet put in the field. Its two main features are its selective ringing, and its lock-out qualities. Another feature which will tend to make it popular with the companies themselves is the system of remedying automatic line troubles from the central office by the simple process of testing the lines by means of the restoring button. Mr. Granger has been working on this patent for the past 12 years.

In order to promote this patent a company has been formed known as the Farmers Automatic Telephone Company with F. E. Granger, president; J. L. W. Zietlow, vice-president, and S. H. Collins, secretary-treasurer.

It is the intention of the company to give the telephone a thorough testing out on some farm line in the very near future, after which its commercial and practical value to the rural patron can be fully determined.

Instruction in First Aid

Safety first and first aid to the injured was presented so graphically to men of the plant departments of the Evanston and Waukegan districts of the Chicago Telephone Company at a meeting recently held in Evanston, Ill., that one of the Waukegan men fell over his chair in a faint and some of the demonstrations had to be put into immediate effect. Cool air served his purpose, however, and he was soon able to come back and hear the finish of the lecture.

By motion picture and later by demonstration the men were instructed how to avoid accidents and if they were hurt, what they should do, before the physician arrived.

H. M. Weber, manager of the relief and aid department, and H. B. Gates, district manager, had the meeting in charge. C. T. Ford, manager of the Waukegan district, had his force of nearly one hundred men and a large share of the sixty who are in the Evanston department in attendance. The men were not satisfied with what they saw, but asked many intelligent questions, proving that they consider safety first something more than a motto.

In order to test the efficiency of the telephone service, the Cumberland Company had one of its best operators begin at 9 o'clock one Friday morning and call up the members of the Rotary club, urging them to attend a special luncheon.

The assistant chief operator was selected for the task and she made a record for quick and efficient service, calling up 124 members and delivering her messages in exactly one hour and one minute.

An American consular officer reports that a Norwegian telephone company wishes to purchase 3,000 kegs (6,613.86 pounds) of silicium bronze wire, the diameter of the wire to be .051181-inch in width with 40 per cent minimum conductivity, and 70 kegs (154.3234 pounds) minimum breaking strain per square .03937-inch, the wire being according to British post office inspection. It is stated that the company is absolutely reliable.

Membership Benefits Small Exchanges

What the United States Independent Telephone Association Does for the Local Company

BY W. S. VIVIAN

WITH reference to the telephone field, some one said, "Co-operation, plus knowledge, plus efficiency, equals service"; co-operation being the foundation, knowledge and efficiency the pillars, and service the roof. Some one else states that there are approximately 20,000 telephone organizations in the United States, each so far as corporate relationship is concerned, independent of the others, and yet, because of the nature of their business, each dependent upon the other.

The association, because it is national in character, becomes the logical medium through which to disseminate knowledge, which, when applied by the local company, produces efficiency and profits. Co-operation of the local companies with the national organization, by becoming members and actively supporting it, is what enables the national association in turn to be of value to the local companies. Let us be specific: The association at the present time maintains two offices, one in Chicago and one in Washington, neither of which could be maintained were it not for the fact that the local companies scattered all over the country make it possible.

As we write this, we have upwards of 400 members scattered throughout 35 states of the Union. These are the companies that make it possible to maintain two offices.

Last year there were two associations, likewise the year before. A bill was introduced at Washington, commonly known as the war tax bill. This bill, as originally presented, provided that on all telephone and telegraph messages amounting to 15 cents or more, the telephone and telegraph companies originating the same, should pay a tax of one cent to the government. This matter was called to the attention of both associations, who in turn called it to the attention of the state associations, and each of the several state and national associations called it to the attenion of their member companies, with the result that this bill was so amended that the tax of one cent on each message should be paid by the patron. This was a mere bagatelle to the individual patron. It would have meant a great deal, however, to each of the local companies. This example of co-operation saved to the local companies throughout our country approximately $800,000 during 1915. The tax has been continued to include 1916, which will mean an additional saving during the current year of approximately $800,000 more, or a total of $1,600,000. Now, let us notice that the fact of the co-operation of the local companies made it possible to maintain offices that could bring such matters to the attention of the companies. No one will say but that if there had been no national organization the probabilities are the bill would have become a law as it was originally drafted and the companies would have had to pay the tax. What did this saving amount to with your company?

Secondly, because of the fact that these companies have a national organization through whom they can deal, they naturally are willing to co-operate with the association when an appeal is sent out.

The Interstate Commerce Commission has jurisdiction over all telephone companies which send or receive an interstate message. It has outlined systems of accounts for Class A, B and C companies. The national organizations have had a great deal to do with the forming of these systems of accounting. The committees representing the associations have held many conferences with those of the commission having charge of this matter. What that service means to the Independent companies or local companies generally cannot be estimated, as the accounts adopted by the commission will unquestionably give the local companies much valuable information which many of them have never had before in their systems of accounting and which will be more fully appreciated later.

The Interstate Commerce Commission is now at work on valuation matters which are prescribed in what is known as the Valuation Act. Some conferences have already been held by the association's Valuation Committee. Last year this was handled by means of a joint committee representing the two associations, but this year, with one national association representing Independent telephony, it will be looked after by one valuation committee. This is going to be a most important work as time progresses and they become more active in the matter. The value of our properties, the rates we may charge, and the return we may secure on our investment, will undoubtedly be ultimately determined by these valuation proceedings. Thus the service to the local companies cannot be over-estimated. This work sooner or later is going to come right home to every local telephone company. What has the work meant to the local companies?

Let us illustrate a few of the phases of our work which comes under our Service Department. During the year 1915, thirty operators' schools were held throughout the states of Minnesota, Wisconsin, Illinois, Indiana, Ohio and Pennsylvania. Wherever these meetings have been held the managers testify that they have been able to notice a material difference in the spirit of the service furnished and the results accomplished. F. H. Runkel, of Portage, Wisconsin, at the convention of the Wisconsin Telephone Association at Madison recently, stated his only regret was that they could not have these meetings at least every three months. An operators meeting was held at Plymouth, Indiana, on the 8th and 9th of March, under the auspices of the Northern Indiana Independent Telephone Association. President Sam Tomlinson wrote, "I believe it would have paid us, from a financial standpoint, if Plymouth had had to bear all of the expense alone."

What the benefits are to the companies, in dollars and cents, can hardly be estimated; but whenever these meetings are held, it produces a beneficial effect on the service of the territory represented in these meetings. Work like this could not be carried on without the co-operation which can be secured only through organization.

Let us cite some legal questions that are submitted to the association occasionally.

Under date of January 6, 1916, the Northern Iowa Telephone Company, of Cresco, Iowa, wrote for information as to the rights of house-movers—whether or not houses could be moved without securing a permit from local authorities—the house-movers in the city contending that telephone and other wire companies had no rights that they must respect. Information on file in this office

was sent by early mail, and here is the letter the company wrote us as a result of the information furnished:

In reply to your kind letter of information of the 13th inst., we have to tell you that we gave the information contained in the letter and the brief to our city mayor and he immediately gave it careful consideration, and the next morning served notice on a house-mover who had violated the ordinance, that he would have a fine to pay. The house-mover appeared with his counsel and asked for a jury trial. The request was granted and court adjourned until next day. The next morning the house-mover and counsel appeared before the mayor and asked that action be dismissed, pleading guilty and paying the fine.

We wish to thank you very much for the attention you gave us in this matter, and we have to say that if others who are not members of the association only knew what benefits they might derive from the same, they certainly would not "hang back" long from joining it. Again expressing our appreciation, we are, Very truly yours,

THE NORTHERN IOWA TELEPHONE COMPANY,
H. G. ADDIE, SUPERINTENDENT.

This is but one of numerous instances that we could mention if space permitted.

What does the association do for the local company? Remember that co-operation is the foundation in this work. In the illustration above, if we had not had the co-operation of the local companies, we would not have had an association, and this information would not have been on file for the use of our member companies. Again, if the local company which in this case was located at Cresco, Iowa, had not bethought itself of the benefits to be derived from the association and submitted the problem to us, the information would have been of no benefit to it, but it co-operated by stating its troubles to us and the problem was solved, as it has been solved for many other companies in recent years because of associated effort.

Our Standardization Bulletin No. 1, of which several thousand copies have been distributed since the first of the year, is an evidence of co-operation and of what the association can do for local companies. The bulletin, called "More Subscribers," containing advertising suggestions, is a direct result of co-operation and an evidence of what the association can do for local companies. Operating rules for long distance purposes, also for magneto and common battery local service, have been compiled and published—an evidence of what the association can do for local companies.

As a matter of fact, there is no limit to what the association can do for the local companies. The greater problem is to get the local companies to realize the advantages offered by the association and to avail themselves of these advantages. The cost of membership in the association is $5.00 a year. In return companies receive benefits, direct and indirect, the value of which, in dollars and cents, greatly exceeds the membership fee. To enable the association to do its best work and the local companies to get the best results for themselves and their stockholders, every local company in the United States should immediately make application for membership in the United States Independent Telephone Association.

Secretary Blomeyer, of the Texas Independent Telephone Association, recently published a paper on "The Value of Statistics." Many splendid suggestions which should be carried out were offered in that paper. The national organization is really a practical solution to that problem because in the association statistics can be gathered and comparisons made and data published that will be of value to every company and which will enable them to know whether the results they are securing from their property are what they ought to be in the light of comparison with other properties.

The association is the logical center for a great information bureau, showing what conditions are all over the country, what labor conditions are, what salaries are paid—the salary question is a controlling factor in the operation of a telephone plant. Every company desires to pay the best salaries it can. It is a problem with many to know just what salaries they ought to pay for various kinds of work. The association can properly compile such information. Such questions as to how many hours constitute a day's work, what holidays with pay, rate for overtime, how many operators, wages and classification, wages on hourly, daily or weekly basis, hours employed each day, information as to bonuses, anniversary payments, sick benefit insurance, pension provisions, etc., are suggestions of information which a national organization can compile which will be of inestimable value to the local company.

Membership pays. There are big dividends in associated effort.

St. Louis Has Single-System Bill

A bill requiring St. Louis, Mo., to use but one telephone system was introduced in the Board of Aldermen by Alderman Barney L. Schwartz, March 17. The bill provides that the contract for telephone service for the city offices and institutions be let to the lowest competitive bidder. Provision is made that the bidders represent companies having established telephone systems embracing the entire city.

Schwartz introduced the bill as a protest against the proposed increase of rates by the Southwestern (Bell) Telegraph and Telephone Company. The city now uses both the Bell and the Kinloch service in addition to its municipal line.

Texas Merger Opposed

A telephone consolidation ordinance has been adopted on its first reading by the City Council in Temple, Texas, and will take its regular course through that body, three readings being required before final adoption. There is considerable opposition to the proposed merger.

The United Telephone Company proposes to take over the exchange of the Southwestern and operate both as one utility. A business telephone rate of $3.50 per month is specified. The United company demanded a rate of $4, but after much discussion agreed to the reduction.

Indiana Court Upholds Commission

Judge Willoughby in the circuit court, March 2, decided the suit on contract brought by a number of the farmers about Bicknell, Indiana, against the Bicknell Telephone Company, in favor of the plaintiffs.

The plaintiffs sued to force the telephone company to operate a switchboard and furnish other service according to a contract entered into with them for the sum of 25 cents a month. The telephone company had raised the price to 50 cents a month with the permission of the Public Utilities Commission. The court held that the previous contract was binding.

Father Time is like a lot of men—hard work is the quickest way of killing him.

Some Experiments on Microphones

*With a Discussion on the Theory of Microphonic Contacts**

BY PROF. P. O. PEDERSEN

IN THE primary circuit of an ordinary telephone transmitter with a metal mouthpiece (Fig. 1) is inserted a slide resistance of, say, 200 ohms. A watch is put on the microphone and the resistance adjusted until the ticking is barely heard in a receiver inserted in the secondary circuit. If the mouthpiece is then heated—by means of a Bunsen burner or otherwise—the intensity of the ticking heard in the receiver is greatly increased. This increased sensitiveness of the transmitter not only completely disappears when the mouthpiece is allowed to cool again, but generally, when all heat is lost, the sensitiveness is even less than it was originally. Owing to the heat capacity of the mouthpiece and adjacent parts, it takes several minutes to bring the microphone through the described cycle. If the mouthpiece and front plate are removed, and the front side of the diaphragm thereby exposed, the above experiment may be repeated in a slightly different way—viz., a Bunsen burner placed in front of the diaphragm at a distance of, say, 10 cm. increases the sensitiveness greatly; the increase appears almost immediately, and is again lost very soon after removing the flame. If the front side of the diaphragm is covered with tinfoil, or if the carbon diaphragm is replaced by one of polished metal, the observed effect is much less pronounced.

These experiments indicate that the increase of sensitiveness is due to the fact that the temperature of the front of the diaphragm is raised above that of the back, the thermal expansion thereby causing the diaphragm to bend forwards (away from the carbon grains). The correctness of this view was proved by the following test: A piece of iron wire 0.5 mm. thick and 10 mm.

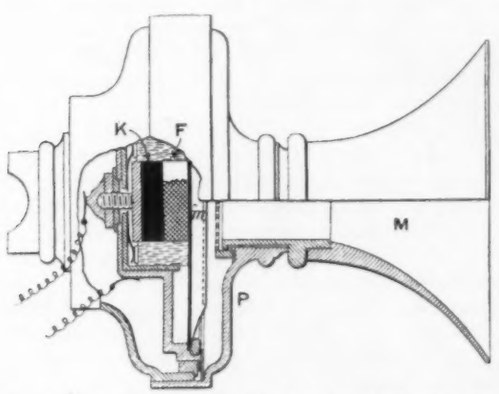


Fig. 1.—Telephone Transmitter Used in Most of the Experiments. (From the Copenhagen Telephone Co.)
m, carbon diaphragm varnished on front side. F, feltring. M, mouthpiece, P, front plate.

long was glued to the front of the carbon diaphragm of the microphone, mouthpiece and front plate being removed. By means of a permanent magnet with one of its poles at a distance of 1 mm. or 2 mm. from the iron wire, the diaphragm could be drawn a little forward. The sensitiveness was then increased. As soon as the diaphragm was released the increase in sensitiveness was lost, and generally more than lost.

For further experiments an electromagnet was substituted for the permanent magnet, and the iron wire was replaced by an iron ring as shown in Fig. 2.

2. *Increase of Sensitiveness is always Accompanied by an Increase of Resistance of the Microphone.*—The resistance is most conveniently measured by the ammeter-voltmeter method indicated in Fig. 3. The microphone

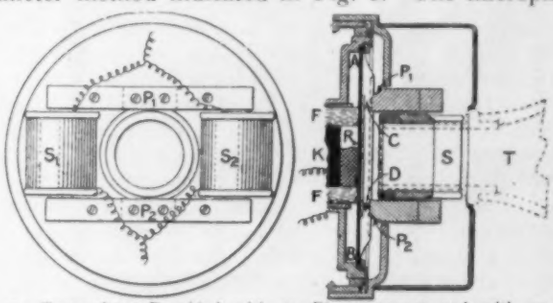


Fig. 2.—Transmitter Provided with an Electromagnet and with an Iron Ring CD Glued to the Diaphragm AB.
S_1 and S_2 are the coils, P_1 and P_2 the pole pieces.

current was usually between 10 and 40 milliamperes, the ballast resistance R_1 accordingly being between 5,000 and 25,000 ohms. As the resistance of the microphone is only at most a few hundred ohms, the microphone current will be practically independent of the resistance of the microphone, which may be read directly on the millivoltmeter *V*.

The experiments showed that the resistance and the sensitiveness of the microphone always varied in the same manner. The increase of resistance in the tests mentioned above was generally about 100 to 150 per cent.

3. A long series of experiments was made in order to investigate the *relation between the increase of resistance and the displacement of the diaphragm.* In one series of tests the displacement was measured by optical interference. In another series a known additional air pressure was applied to the capsule and the displacements calculated on the basis of the known elastic properties of the diaphragm. In a third series the back electrode (*K* in Figs. 1 and 2) was drawn backward by a micrometric device. This has the same effect as a forward displacement of the diaphragm. The result of all measurements was that an outward displacement of either diaphragm or back electrode of 1 to 2μ* causes an increase of the resistance of 100 to 200 per cent or even more.

Another series of experiments may be described in some detail here. The microphone capsule was firmly clamped on a stand with its diaphragm in the normal (vertical) position, and the shellac was removed from the central part of the diaphragm. A metal pin with a rounded end could be pushed against the central point of the diaphragm and moved to and from by a fine micrometric screw. The tests were carried out in this way: The metal pin was pushed against the diaphragm and the whole apparatus shaken until the resistance had attained its normal value of about 100 ohms. The pin was then moved backward very cautiously, and a set of

* Abstract of an article in the Danish journal *Elektroteknikeren*.
All the experiments were carried out in the telephone laboratory of the Royal Technical College in Copenhagen.

* $1\mu = 0.001$ mm.

corresponding micrometer and resistance readings noted† until the pin ceased to touch the diaphragm. The results of four sets of measurements are shown in Fig. 4. The curves end at the points where the connection between pin and diaphragm was broken. In curve 1 the original inward displacement was about 7μ, in curve 4 about 51μ. The final resistance was between 3.1 times the initial

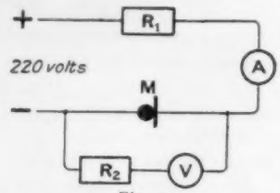


Fig. 3.
M, microphone. A, milliammeter. V, millivoltmeter. R_1 and R_2 resistances.

resistance for curve 1 and 6.8 times for curve 4. Experiments proved that the sensitiveness of the microphone also in this case increased with increasing resistance.

4. *Transmitter with Press Button.*—The abovementioned experiments show that the resistance of a transmitter may equally be increased by a *transitory* inward displacement of the diaphragm as by a permanent outward displacement. An arrangement by which the diaphragm may be given such a transitory displacement without any danger of hurting the diaphragm or other parts of the microphone is shown in Fig. 5. On the flat spring *ABA* is fastened the press button *PB* and an insulating Pin, *P*. When the button is pressed *P* exercises a slight pressure on the diaphragm *m*, and this pressure ceases as soon as the button is released. The result is a great increase of the resistance and a corresponding increase of sensitiveness. Table I. shows some of the results obtained with such a transmitter. R_1 is the resistance just after shaking the transmitter, R_2 the resistance when the button has been pressed. It appears that the ratio R_2R_1 has the greatest value for small currents. The normal current is 20 milliamperes, and for 30 milliamperes the ratio is still about 2.5. *When the transmitter, before pressing the button, is "packed" this ratio is, of course, much greater.*

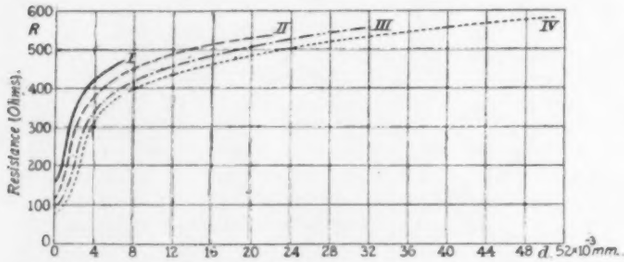


Fig. 4.—Displacement of Diaphragm from its Inmost Position.

The acquired increase of resistance is naturally lost when the transmitter is violently shaken, but it possesses a remarkable stability. The transmitter may be moved about and turned in all directions up to angles of, say, 30 to 40 degrees, and still retain about half of the original increase. The increase of resistance dies gradually away when spoken into the transmitter. When speaking very loud the natural state is reached in a few seconds; under faint speaking it may take several minutes.

5. *Explanation of the Obtained Results.*—A microphone with only one spherical carbon grain (Fig. 6) behaves in the same manner. When cutting away the carbon outside the lines *aa* and *bb* it is possible in this case to investigate the movements of the working parts in a feebly magnifying microscope. If the diaphragm *m* is strongly pushed back, the carbon sphere will be forced up the conical slope of the back electrode *E;* if the diaphragm is then suddenly released the sphere cannot follow it, but runs down the slope, and with the momentum thus acquired wedges its way between the diaphragm and the back electrode. The pressure between the three parts will then be relatively great and the resistance small. If, on the other hand, the displacement of the diaphragm is only small, and is produced and released gently, the carbon sphere will follow the movements of the diaphragm the whole time, and there will be no "wedging" effect; the pressure will be that corresponding to the weight of the sphere, and comparatively small, the resistance rather great. Consequently, ordinary shaking is most liable to give a small resistance, as confirmed by the tests.

† The test current used in the resistence measurements was very small.

TABLE I.

Microphone current, Milliamps.	*Resistance.* R_1 *Ohms.*	R_2 *Ohms.*	R_2/R_1.	*Remarks.*
2.5	128	552	4.31	.....
	160	568	3.55	.....
	128	520	4.07	.....
	116	520	4.49	.....
	128	592	4.64	.....
	120	608	5.06	.....
	128	604	4.72	.....
	128	616	4.83	.....
	144	528	3.67	.....
10.0	125	370	2.96	Mean of 15 tests.
15.0	113	295	2.61	" 9 "
20.0	95	245	2.59	" 7 "
30.0	74	182	2.46	" 8 "

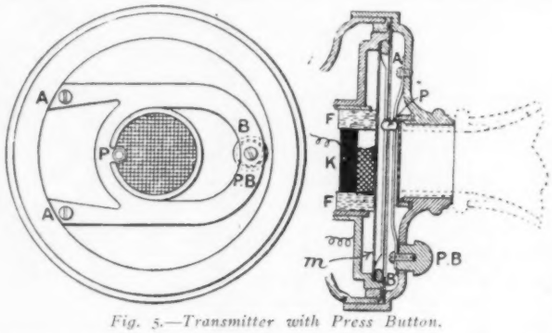


Fig. 5.—Transmitter with Press Button.

The conditions are somewhat similar in the ordinary grain-microphone. By shaking, some of the grains acquire a considerable momentum and some of them will, before they are brought to rest, wedge in between other grains or between the grains and diaphragm, or back electrode, thus increasing the pressure and reducing the resistance. If, on the other hand, the diaphragm is given a small permanent outward displacement or a small transitory inward displacement the final result will be a reduced pressure between the grains, and, therefore, an increase of resistance.

6. It appears from the proceeding experiments that *the resistance of the transmitter must be very sensitive to variations in the air pressure in the capsule,* or more correctly, to variations in the difference of air pressure inside and outside the capsule. A rise of pressure in the capsule will give the diaphragm an outward displacement and thereby cause an increase of resistance. This explains satisfactorily the transient increase of resistance observed immediately after the current has been put on. Some measurements were made using the arrangement shown in Fig. 3, and Fig. 7 shows the results of these tests. The explanation is very simple. Just after the current is put

on, the temperature in the grain chamber rises rapidly owing to the Joulean effect $\frac{1}{2}I^2R$, and the rise in temperature is accompanied by a corresponding rise in air pressure in the grain chamber. This increase of pressure gives the diaphragm an outward displacement, and consequently the resistance rises. After some time the temperature in the grain chamber attains a steady value. The higher pressure in

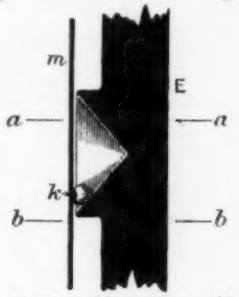


Fig. 6.—Working Parts of a Microphone with only one Spherical Carbon Grain.

the grain chamber will force some of the air to escape through the felt ring, and the pressure in the grain chamber will, therefore, attain its greatest value some time before the steady temperature is reached, and after that time the diffusion through the felt ring will gradually bring the pressure back to its original value. (The outer capsule was provided with holes in order to have the same air pressure on both sides of the diaphragm outside the grain chamber.) This explains satisfactorily the curve *a* for the normal transmitter shown in Fig. 1. In order to test the correctness of the view that the increase of resistance is mainly due to a rise in air pressure in the grain chamber, a hole 5 sq. mm. was cut out at the top of the felt ring. The *b* curve was then obtained, showing the correctness of the view.

Only one point remains to be discussed. As the heat is mainly generated in the contacts between the grains it must take some short time after the closing of the circuit before the air pressure can appreciably alter and still more before the diaphragm can be forced away. This is not clearly set out by Fig. 7, but an oscillographic investigation proved clearly that the tangents to the *a* and *b* curves at the point $t=o$ were horizontal. After a sufficient time the resistance of the current-carrying transmitter will be less than the initial resistance; the reason why will be given later on.

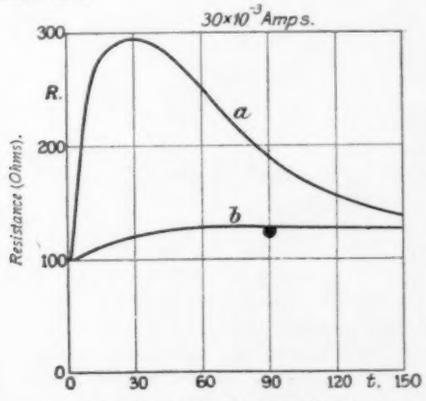


Fig. 7.—Variation of Transmitter Resistance during the Time After Closing of Circuit.
Curve A.—Normal transmitter (Fig. 1).
Curve C.—Same transmitter with a 5 sq. mm. hole at the top of felt ring.

7. *Relation between the Resistance and the Sensitiveness of a Microphone.*—The preceding experiments show that the resistance and the sensitiveness vary in the same manner and as the resistance is much more easily determined we have up to the present confined ourselves to resistance measurements. In order to judge the importance of a certain increase of resistance it is, however, necessary to establish a quantitative relation between resistance and sensitiveness of the transmitter in question. As a first step in this respect it will be necessary to state exactly what is meant by sensitiveness.

If a microphone is acted on by a pure tone of constant instensity and frequency n, the resistance may approximately be put in the form

$$R=r-r'\cos 2\pi nt=r-r'\cos \omega t. \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Here r is the mean resistance during the action of the tone, and is generally different from the resistance of the microphone when at rest; r' is the amplitude of the harmonical variations in the resistance caused by the action of the tone. The greater the value of r' the greater is, *cet. par.*, the alternating microphonic current. We, therefore, use r' as a measure of the sensitiveness. In this investigation we are only concerned with the relative sensitiveness—that is, with ratios between the different values of r'.

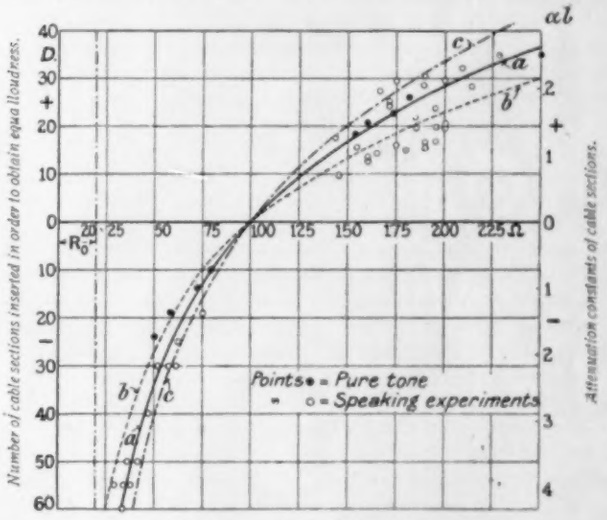


Fig. 8.—Relation Between Sensitiveness and Resistance of a Telephone Transmitter for Constant Current.

The strength of the alternating current caused by the harmonic resistance variations is easily found. Let V be the E.M.F., $R_1+r-r'\cos\omega t$ the total resistance, and L the self-inductance of the microphone circuit. If r' is small compared with r, the momentary value of the current may be put in the form

$$i=I_0+I'_m\cos(\omega t+\psi), \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where

$$I_0=\frac{V}{R_1+r}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

and

$$I'_m=\frac{r'I_0}{\sqrt{(R_1+r)^2+\omega^2L^2}}=r'\frac{V}{(R_1+r)\sqrt{(R_1+r)^2+\omega^2L^2}} \quad (4)$$

In cases where r is very small compared with R_1 (4) may be written

$$I'_m=\frac{r'I_0}{\sqrt{R_1^2+\omega^2L^2}}=r'\frac{V}{R_1\sqrt{R_1^2+\omega^2L^2}} \quad . \quad . \quad . \quad (4')$$

I'_m is the maximum amplitude of the alternating current and according to (4) proportional to the product of r' and I_0. (The microphone acts like an alternating-

current generator with a maximum E.M.F. of $(r'I_0)$ and a resistance r.)

The next step is to determine the empirical relation between r' and the transmitter resistance R. To this end the above-mentioned transmitter with electromagnetic displacement of the diaphragm (Fig. 2) was inserted in a circuit in series with a 110-volt battery, the primary windings of a telephone transformer, and sufficient resist-

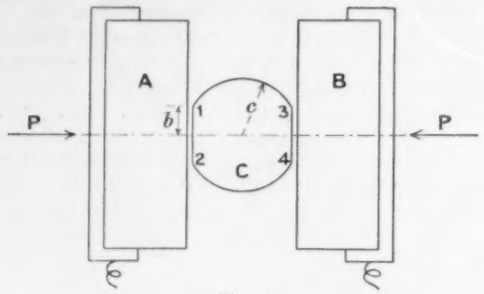


Fig. 9.

ance to keep the microphone current at 20 milliamperes. In series with the secondary windings of the transformer was inserted an artificial cable with 120 equal sections, each one having an attenuation constant of 0.071 (for $2\pi n$=5,000). A high resistance receiver could be shunted across the cable between any two sections. The tension at a point not too near the open end of the cable is given by

$$E = E_0 \cdot e^{-0.071D},$$

where D is the number of sections between the transformer and the point tested and E_0 the tension at the transformer terminals. As the resistance of the microphone is very small compared with the total resistance of the microphone circuit we may use the approximate formula (4′) and consequently E_0 is proportional to r' but independent of r. As a sound generator I used alternately an Abs. Larsen's microphone hummer and a person speaking evenly. The resistance of the microphone was altered by sending various currents through the electromagnet which governs the displacements of the diaphragm. The microphone resistance was read on a millivoltmeter as usual, and the position of the receiver in the cable was regulated until a certain standard loudness was obtained in the receiver. Now and then the transmitter was shaken in order to bring it to its normal state.

The results of the tests are shown in Fig. 8. The mutual agreement between the different tests is not very good, but the experiments are rather difficult and the inborn intricacies of a microphone so great that considerable errors were to be expected.

The total resistance R of the microphone may be divided into two parts, $R = R_0 + R'$, where R_0 is the *inactive* and R' the *active* resistance (*see* next paragraph). R_0 is that part of the resistance which is independent of the pressure between the working parts—that is, the resistance of leads, electrode, diaphragm, &c. R' is that part of the resistance which varies with the pressure: it is the proper microphonic resistance. With high and increasing pressure the total resistance asymptotically approaches the value of the inactive resistance. It is evident that the sensitiveness must depend principally on R', and not on R. In Fig. 8 the inactive resistance is fixed at 20 ohms, 100 ohms being the normal total resistance of the transmitter. We shall, however, defer the discussion of the obtained result until later on.

8. The total resistance R between two carbon pieces consists of three parts—

$$R = R_0 + R_1 + R_2.$$

R_0 is the *inactive resistance*, which is, within practical limits, independent of the pressure between the pieces. R_1 is the proper *contact resistance*—that is, the resistance due to the intervening layer. R_2 is the *spreading resistance* from the area of the contact to the bulk of the pieces. The two last ones taken together form the *active resistance* $R' = R_1 + R_2$. In the following investigations we are only concerned with the active resistance, and the inactive resistances have been deducted from all experimental data.

The theory here tentatively put forward rests on the following hypotheses:—

(*a*) *The product of contact resistance R_1 and contact area a is independent of the contact pressure P*, providing the current I through the contact is small.

(*b*) The contact resistance depends on the current in the following way:—

$$R_1 = \frac{\sigma}{a} - \frac{\beta R_1 I^2}{P^{2/3}},$$

where σ is the specific contact resistance for small currents and β is a constant.

In order to simplify the calculations we restrict our investigations to the case shown in Fig. 9—viz., a carbon sphere, with radius c cm., slightly pressed between two carbon plates. The radii of the circular contact areas are denoted by b.

The carbon used was hard homogeneous microphone carbon, which had a resistivity ρ=0·0091 ohms/cm.³ and a Young's modulus, E, estimated to $250 \cdot 10^6 g/\text{cm.}^2$.

9. *The Spreading Resistance R_2.*—The resistance from the contact area 12 through the sphere to 34 (*see* Fig. 9) is given by

$$\frac{\rho}{2b} - \frac{\rho}{2\pi c} \cdot \log \frac{b}{2c},$$

provided b is very small compared with c. The spreading resistance from 12 to A or from 34 to B is $\rho/4b$. The total spreading resistance between A and B is, therefore,

$$R_2 = \frac{\rho}{b} - \frac{\rho}{2\pi c} \cdot \log \frac{b}{2c}.$$

As b is small compared with c, we have approximately

$$R_2 = \rho/b \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

10. *The Relation between Contact Resistance and Pressure.*—According to our hypotheses we have

$$R_1 = \frac{\sigma}{a} - \frac{\beta R_1 I^2}{P^{2/3}}. \quad . \quad . \quad . \quad . \quad . \quad (7)$$

For the present we shall only consider such cases in which the current is so small that the last term in (7) can be neglected. We may call the corresponding resistance R^0_1 and have

$$R_1^0 = \frac{\sigma}{a} = \frac{\sigma}{\pi b^2}. \quad . \quad . \quad . \quad . \quad (8)$$

According to a well-known formula of H. Hertz, b and a are given by

$$b = 1{\cdot}11 \left(\frac{Pc}{E}\right)^{1/3} \text{ and } a = 3{\cdot}87 \left(\frac{Pc}{E}\right)^{2/3} \quad . \quad . \quad . \quad (9)$$

$$\therefore R_1^0 = \frac{\sigma}{3{\cdot}87} \left(\frac{E}{Pc}\right)^{2/3} \quad . \quad . \quad . \quad . \quad . \quad (10)$$

Hence

$$R^{01}=R_1{}^0+R_2=2\frac{\sigma}{a}+\frac{\rho}{b}=\frac{\sigma}{1{\cdot}94}\left(\frac{E}{P_c}\right)^{\frac{2}{3}}+\frac{\rho}{1{\cdot}11}\left(\frac{E}{P_c}\right)^{\frac{1}{3}} \quad (11)$$

This equation gives, for small currents, the relation sought between active resistance and pressure.

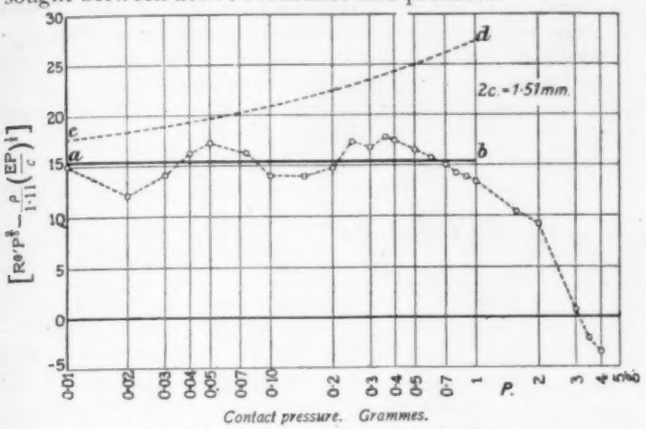


Fig. 10.—Carbon Sphere 1.51 mm. in Diameter.

In order to test the validity of (11) it is more convenient to write this equation in the following form:

$$R^{01}\,.\,P^{\frac{2}{3}}-\frac{\rho}{1{\cdot}11}.\left(\frac{EP}{c}\right)^{\frac{1}{3}}=\frac{\sigma}{1{\cdot}94}.\left(\frac{E}{c}\right)^{\frac{2}{3}} \quad . \quad . \quad (12)$$

In (12) the right-hand side is independent of the pressure P. If our theory is valid, the left-hand side will also be independent of P. In order to test this, a long series of experiments was made, using carbon spheres of diameters from 0·5 mm. to 10 mm. In each series a set of corresponding values of P and R_{01} were measured and the left-hand side of (12) was calculated. The values obtained for two series of tests are shown in Figs. 10 and 11 by small circles connected by a broken line. The results are fairly constant up to a certain pressure, P_b, corresponding to the points marked b in the figures. For higher pressures the left-hand side of (12)

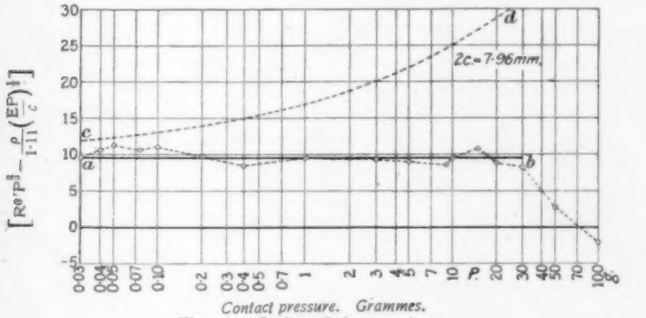


Fig. 11.—Carbon Sphere 7.96 mm.

falls off rapidly. The mean value of the left-hand side up to this point b is shown by a thick line, ab.

In Table II are to be found a few of the values obtained.

TABLE II.

Diameter of sphere. $2c$	P_b.	S.	f_0.	σ.
0.047 cm.	0.080 g.	811 kg./cm.²	82.0	3.30×15^{-5} ohm/cm.²
0.151 "	1.00 "	865 "	15.3	1.34×10^{-5} "
0.797 "	30.0 "	893 "	9.7	2.54×10^{-5} "

If the maximum stress S, corresponding to the pressure P_b, is calculated, the value of S thus found is always about 800 to 900 kg./cm.². The carbon can hardly be expected to stand any greater stress.

It therefore appears *that equation* (12) *holds good*, within the limit of experimental error, *for all pressures up to the breaking point of the carbon.*

Table II also contains the mean value f_0 of the left-hand side of (12) up to the point b, and the corresponding value of σ calculated from (12); σ varies considerably from case to case, but its magnitude is of an order of a hundred-thousandth of an ohm per square centimetre. The variations in σ are, no doubt, mainly due to slighter impurities on the surface of the carbon. Even minute impurities may raise the value of σ a thousand times or more.

In Fig. 10 and 11 the dotted lines cd indicate the value of

$$g=f_0+\frac{\rho}{1{\cdot}11}\left(\frac{EP}{c}\right)^{\frac{1}{3}} \quad . \quad . \quad . \quad . \quad (13)$$

For any definite value of P the ratio $(g-f_0)/f_0$ is equal to the ratio $R_2{}^0/R_1{}^0$. It appears that for small values of P—that is, for all microphonic pressures—*the contact resistance is far greater than the spreading resistance.*

11. *Relation between Resistance and Size of Grains.*—From equation (11) it appears that the active resistance of the contacts shown in Fig. 9 only depends on $P\,.\,c$—that is, on the product of the pressure and the radius of the sphere. We have investigated the validity of (11)

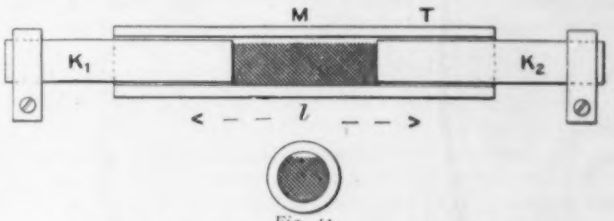


Fig. 12.

T, glass-tube. K_1 and K_2, carbon rods. M, carbon grains.

for variations of P. We may, theoretically, do the same for variations of c. But a great practical difficulty is here met with in the form of the above-mentioned uncertainty in the value of σ. In order to eliminate this uncertainty it would be necessary to carry out a very great number of tests and find the mean values of the results obtained. This difficulty is overcome by measuring the volume resistance of a mass of grains containing a great number of these. If the grains of different sizes are made of the same sort of carbon it is to be expected that the deviations from the normal value of σ will mutually compensate each other, and the measured resistance, therefore, will only depend on the size of the grains in the manner required by our theory, provided this theory is right. The grains were placed in the apparatus shown in Fig. 12. The hole in the glass tube had a cross-section of 1·02 sq. cm. The distance between the carbon ends K_1 and K_2 was always chosen so great that the grains did not fill the whole cross-section of the tube, but only about 1·00 cm.². The resistance was measured as indicated in Fig. 3, and the test current was small. Before every measurement the apparatus was gently shaken. For every length l, corresponding to a total volume of grains of l cm.³, a number of measurements were made and the mean formed. The greatest deviations seldom exceeded 5 per cent.

Such measurements were made with grains consisting of carbon spheres of diameters $2c$=1·53; 1·00 and 0·47 mm. respectively. The results are shown in Fig. 13. R_1 is the resistance corresponding to the length l. The relation between R_1 and l can approximately be represented by the three straight lines. The resistivity ρ^0 of the grain-mass is given by $\rho^0=(R_4-R_0)/4$. The results are summarized in Table III.

The relation between ρ^0 and $2c$ as required by our

theory is easily found if we neglect the spreading resistance and only consider the contact resistances. The number of contacts in parallel are proportional to $1/c^2$, of contacts in series to $1/c$. The pressure on each one of the contacts is proportional to c^2, the resistance, therefore, to $1/c^2$. The resistance ρ^0 per cubic centimetre is, therefore, proportional to $c^2 \cdot c^{-1} \cdot c^{-2} = c^{-1}$. The result is that the product $2c \cdot \rho^0$ shall be constant. The experimental agreement is fairly good.

TABLE III.

$2c$	ρ^0.	$2c \cdot \rho^0$.	R_0.
1.53 mm.	20 ohms	30.6	26 ohms
1.00 "	29 "	29.0	20 "
0.47 "	76 "	35.7	27 "

The resistance $R(l=0)$ is the resistance between the grains and the flat ends of the carbon electrodes. It is easily proved that this resistance, according to our theory, should be independent of c. This consequence is also approximately satisfied.

A number of tests were also made with ordinary sharp-edged grains of different sizes. The grains were made from the same sort of carbon, and were sorted by means of sieves with circular holes of different sizes. In Table IV, containing the results of these experiments, $2c$ denotes the diameter of the holes which the grains were just able to pass.

TABLE IV.

$2c =$	2.3	2.1	1.9	1.7	1.5	1.3	1.1 mm.
$\rho^0 =$	380	410	560	582	685	734	824 ohms.
$\rho^0 \cdot 2c =$	874	860	1,060	990	1,030	954	906 "
$\rho^0 \cdot (2c)^{1/3} =$	502	525	694	694	781	801	849 "

In applying the theory to this case the question is: What are the radii of curvature at the points of contact? If these radii are independent of the size, it is easily found that, according to our theory, the product $\rho^0 \cdot (2c)^{1/3}$ should be constant. Table IV shows that there is a systematical deviation from this law. If, on the other hand, the radii of curvature are proportional to the size of the grains, the theory demands that $(\rho^0 \cdot 2c)$ shall be constant, as in the case of spherical grains. Table IV shows that $(\rho^0 \cdot 2c)$ is fairly constant. There is some reason to believe that the edges of the big grains really are somewhat more rounded than on the small ones. The edges cannot be mathematically sharp, they must be more or less rounded, and the forces tending to do this are greater for big grains than for small ones.

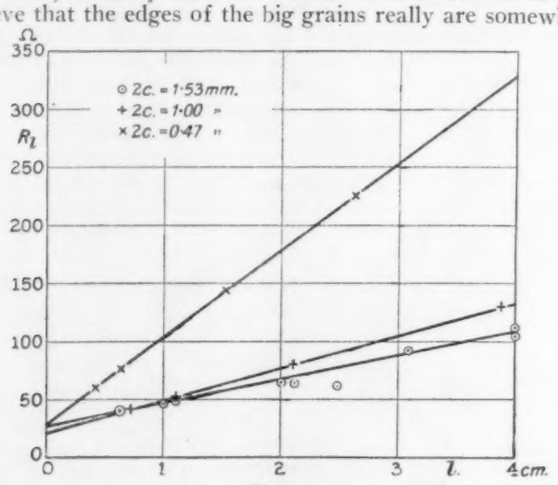


Fig. 13.

Another observation bearing on this point is the following: If some of these grains are put in a box and violently shaken for one to two minutes their ρ^0 is reduced by 30 per cent or more.

12. *Relation between Resistance and Strength of Current.*—It is a well-known fact that the contact resistance decreases when the current rises. A part of this reduction of resistance takes place immediately after the increase of current, while the remainder only dies away gradually. The last part, which is mainly due to the heating effect of the current, has no greater microphonic interest, as the variation is too slow. We shall, therefore, only consider the first instantaneous effect.

According to our hypotheses, the relation between contact resistance and current is given by

$$R_1 = \frac{\sigma}{a} - \frac{\beta R_1 I^2}{P^{2/3}}, \quad . \quad . \quad . \quad . \quad (14)$$

or, solved with regard to R_1,

$$R_1 = \frac{\sigma/a}{1+\beta I^2 P^{2/3}} = \frac{\sigma E^{2/3}}{3{\cdot}87\ C^{2/3}(P^{2/3}+\beta I^2)} = \frac{+C}{P^{2/3}+\beta I^2} \quad (15)$$

R_1 is the initial value of the resistance just after the current has been switched on. Equation (15) may also be used to determine the variation of R_1 for sufficiently rapid variations of the I current about a mean value, I_0, even if the constant value of R_1 corresponding to the constant current I_0 is not given by (15).

According to (14), the initial reduction of the resistance due to the current is proportional to the power lost per unit area of contact.

The validity of (15) was investigated in the following way: For a given pressure the resistance $R_1^0 + R^2$ was first measured by means of a very small current, the stronger current was then put on and the resistance $R_1 + R_2$ measured at once. The sphere was then turned, or a new sphere inserted, the pressure again put on and a new measurement taken in the same way. The results of three sets of tests on 1·51 mm. spheres are shown in Fig. 14. The values of R_{10} may vary considerably (*see* 10), but the experimental values have all been reduced to an initial resistance of 100 ohms, and the curves shown in Fig. 14 are the result of a geometrical interpolation between the experimental results.

In order to compare the experimental data with equation (14) it is necessary to obtain the values of R_1^0 alone, and therefore to deduct R_2 from the experimental values shown in Fig. 14. R_2 can be calculated from the known constants of the carbon, and the values obtained are inserted in Table V. This table also contains the values assigned to β in the three cases. These values of β have been inserted in the formula (15), and the resistance calculated from this formula for various currents. The results are marked by small circles in Fig. 14. The agreement between the theoretical and the experimental values is very good. For a complete transmitter similar curves were obtained.

TABLE V.

P.	R_2.	β.
0.200 g.	31 ohms.	1.08×10^3
0.100 "	27 "	1.01×10^3
0.020 "	17 "	1.05×10^3

13. *The Microphonic Sensitiveness* is proportional to the ratio of a small increment in pressure to the corresponding decrement in resistance. In accordance with (7), we denote the sensitiveness by r', and supposing the spreading resistance may be neglected compared with the constant resistance, it appears from (15) that

$$r' = \frac{dR_1}{dP} = \frac{2}{3} \cdot \frac{C}{P^{1/3}(P^{2/3}+\beta I^2)^2} = \frac{2}{3} \cdot \frac{R_1^2}{CP^{1/3}} = \frac{2}{3} \cdot \frac{R_1^2}{C\sqrt{\frac{C}{R_1} - \beta I^2}}. \quad (16)$$

For small currents this formula reduces to

$$r' = \frac{2}{3} \cdot \frac{R_1^{\frac{5}{2}}}{C^{\frac{3}{2}}} = \text{Constant} \cdot R_1^{\frac{5}{2}} \quad . \quad . \quad (17)$$

In order to compare this result with the experiments described in (7), and which have been included in Fig 8, we have drawn three curves in this figure corresponding to the exponents 3, 5/2 and 2 respectively in formula (17). There is no doubt that the exponent 5/2 gives the best, and a fairly good, representation of the experimental data.

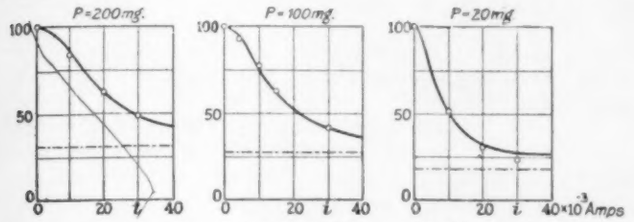


Fig. 14.—Relation Between Initial Resistance and Current for 1.51 mm. Sphere.

14. The investigation has, within the experimental limits, supported the theory advanced—that is. it has proved the constancy of σ and β within the said limits; but it has not given any indication as to the nature of these constants. It appears to me that the next step to be taken in order to elucidate the intricate and very interesting question of microphonic action must be an investigation of the physical nature and behavior of σ and β.

Engineers' Welfare Organization Making Good

Good engineers are needed by the Co-operative Service Clearing House of the American Association of Engineers to fill positions that are referred to them by employers in all parts of the United States, reports Secretary Arthur Kneisel.

Business is being done on a large scale by this association, which started in September, 1915. At present there are 400 certified members. An additional 150 engineers have made applications and are being transferred to the certified class as fast as their qualifications can be verified.

OFFICIAL DATA ON ACTIVITIES FROM MARCH 1, TO MARCH 25, 1916:

Applications received for members	92
Open positions reported	50
Members applying for positions	32
Non-members applying for positions	6
Positions filled	15
Positions on list unfilled	30
Members unemployed (March 25, 1916)	4

The positions on the unfilled list range from $1,200 to $5,000 per year and some of them have been open for several days because the list of engineers on file desiring positions is very limited. If all engineers in America knew of the benefits they could confer upon their profession as well as gain in a personal way from this great movement of co-operation, it is believed that the lists would soon be filled with progressive engineers of high qualifications who would advance and co-operate with the American Association of Engineers.

The association tries to discourage its members from changing positions unless obviously they are underpaid or unless they are better fitted for work other than that on which they are engaged. Unnecessary changes are expensive in time and money both to the employer and to the employee.

Oklahoma Independent Telephone Convention

The meeting of the Oklahoma Independent Telephone Association, held at Oklahoma City on March 24 and 25, was a great success. The association is a strictly Independent organization, having only as its members owners and operators of Independent telephone properties, and members and representatives of independent telephone supply companies. The organization is but little more than one year old, having been organized in January, 1915. It organized with fifty exchanges represented on its roster, a year ago, and at its meeting on the 24th and 25th, it added to its membership, seventeen new companies, and eight representatives of Independent supply concerns and others eligible to membership.

The forenoons of both days were given to visits among members and inspection of exhibits of supply houses. In the absence of D. F. Vincent, president of the association, E. D. Evans, secretary, presided and delivered the welcome address. H. E. Musson, telephone and electrical engineer of the State Corporation Commission, delivered an interesting address on "Aims and Objects of Association," and impressed on the members that it is through organization and association that beneficent results in the interests of the industry are usually obtained, ad that through co-operation among those in the telephone business their interests are being and can always be promoted. J. W. Coffey of the Coffey Audit and System Company, of Indianapolis, was unavoidably absent, and T. D. Trickey, auditor of the United Telephone Company, Afton, Oklahoma, was substituted and read before the meeting an interesting and instructive paper on "Telephone Accounting." O. A. Cox, of the Cox Multiple Lightning Arrester Company, Eaton, Ohio, was called and chose his own subject, and made a very forceful argument in favor of close and strong organization. J. A. Smith addressed the association upon general questions of mutual interest, in which he maintained that in his judgment, municipal control over public utilities was better for the industry than state control. Upon his quesiton he invited antagonism, and a number of members came back at him with herculean arguments in favor of State control, in which they lauded the State Corporation Commission in the strongest terms. It appeared to be the consensus of opinion that as long as the personnel of the Corporation Commission is made up of men of honesty and integrity, it is much better for the utility to have a common governmental control, than to have to deal with local authority which cannot know and has no opportunities to know anything of the business with which they will undertake to deal.

Saturday afternoon, H. W. Hubenthal, superintendent of the United Telephone Company, delivered an instructive address on the subject, "Telephone Engineering and Service," going into detail as to the manner and methods of eliminating trouble and obviating the necessity for kicks to obtain adequate service.

One of the most instructive addresses of the meeting from an operating standpoint was by Herbert J. Clark, of the Kellogg Switchboard and Supply Company, Kansas City, on the subject of "Magneto Maintenance." Every one present felt that they had been greatly benefitted by this presentation on a subject of so much interest.

E. C. Patton, general attorney for the association, spoke on the subject "History and Results of our Association," going into much detail upon what has been accomplished for the members through its organization during the past year. Among the results outlined by Mr. Patton

were increases in rental rates for eight companies, obtaining a more fair and equitable division of toll revenues for all companies who were members; having worked out the right to route messages over Independent toll lines, as initial lines, in the transmission of messages through connections with Bell toll lines; that is when the Independent exchange owns a toll line in the direction of the delivering point of the message, the Independent company should have the right to route the message as far as it can over its own line, and take a line haul in the revenue from the message. Another advantage accomplished has been physical connections of Independent toll lines with Bell toll lines. Mr. Patton stated that the only fight that the association has lost was upon the rates to be paid for switching farmer lines, where the company was charging fifty cents per telephone, and the commission, by order, reduced the charge to twenty-five cents. This case, however, is pending on appeal in the supreme court, and the prospects for a reversal of the order are fair. He stated further that in all the protests filed upon valuations by the State Board of Equalization, they had been able to obtain reductions of from fifteen to thirty per cent below the tentative assessment.

A. J. Roberts, of the Garford Manufacturing Company, entertained the convention with a discourse on the subject, "Independent Equipment for Independent Exchanges." His was a masterful appeal to the Independent telephone companies to stand by the Independent dealers, to buy their equipment and supplies from them in preference to companies controlled by or associated with the Bell company.

B. H. Batte of the Utilities Indemnity Exchange enlightened the association upon the plan and the advantages in liability or indemnity insurance. A vote of thanks was extended to all visiting speakers; and after election of officers the association was entertained with a comical discourse by Jack D. Milburn of the Stromberg-Carlson Company, on the subject "How Do You Hear Me Now?" "Yes, There Is a Bird on the Wire."

Officers elected were as follows: C. E. Devon, of Apache, president; Troy A. Simpkins, Minco, vice-president; H. W. Hubenthal, Afton, secretary; A. Gordon, Mangum; M. M. Flinckinger, Kingfisher; George Massey, Watonga; George Holt, Quinton, and E. D. Simpkins, in addition to the president and secretary, comprise the Executive Committee.

The meeting adjourned subject to call for the next meeting by the Executive Committee, with the understanding that the date would be fixed to conform as nearly as possible with the line of meetings that will be attended by exhibitors and officers of the United States Independent Telephone Association.

No Slugs in Los Angeles

The problem involving the use of slugs and bad coins in pay telephones in Los Angeles was considered at a public hearing before the city council sitting as a committee of the whole.

At the conclusion of the hearing the city attorney was instructed to submit an ordinance making it a misdemeanor for persons to deposit slugs or bad coins in any prepayment machine or device inside the city limits. It was explained that this provision will apply not only to pay telephones but all vending machines and devices within Los Angeles.

Furthermore the committee of the whole instructed the Board of Public Utilities and the city attorney to prepare data and information to be laid before the State Railroad Commission in an effort to have the State Railroad Commission abolish the compulsory use of pay telephones in all public places.

In this respect it was explained that it is proposed to leave it optional with business men and others whether pay telephones shall be installed.

Representatives of both telephone companies were present. In so far as possible, the committee of the whole was informed, the two companies will co-operate with the city in laying the matter before the State Railroad Commission with a view of having all prepayment telephones removed from the city hall and hall of records.

The committee of the whole also considered the question of compelling the telephone companies to refund the nickel when the person calling is unable to obtain the party called.

President Lane of the Board of Public Utilities declares that the question of telephone service regulations will remain in the hands of the State Railroad Commission. The committee of the whole was informed that the commission probably will hold a hearing on rates in a few weeks.

Ohio State's Annual Meeting

Only one change was made at the annual meeting of stockholders of the Ohio State Telephone Company at Columbus, March 14. James M. Hutton of Cincinnati was elected a director to succeed the late George D. Eustis.

The reports of the company were pronounced encouraging. President S. G. McMeen gave the total revenues as $3,249,017, total expenses $2,181,552, leaving the income $1,067,465. After deducting fixed charges, which amounted to $552,458, the net earnings were $515,007. Dividends on preferred stock amounted to $313,055, leaving a net surplus of $201,952. The company charged off a sufficient amount, it was stated, for depreciation. Many betterments and extensions were arranged for.

The officers re-elected are Frank A. Davis, chairman of the board; S. G. McMeen, president; G. R. Johnston, vice president; W. L. Carey, secretary; H. B. Taylor, treasurer. They, with the following, are directors:

F. R. Huntington, Columbus; E. R. Sharp, Columbus; Charles A. Otis, Cleveland; J. K. Secor, Toledo; F. F. Prentiss, Cleveland; William Hardee, Toledo; A. McL. Marshall and H. C. Kiefaber, Dayton; D. J. Cable, Lima; H. B. Peters, Lancaster, and Clarence Brown, Toledo.

Improvement of Paris Telephone System

Commercial Attaché C. W. A. Veditz, Paris, France says it is reported in the papers that the French government has drawn up a bill to be presented to Parliament providing for an outlay of over 120,000,000 francs ($23,160,000) for the improvement and extension of the telephone system of Paris. A technical commission has been appointed and has handed in its report. According to Le Petit Parisien the chief provisions of the proposed scheme are as follows: The construction and equipment of six large new telephone exchanges in Paris; the enlargement of three existing telephone exchanges; the introduction of new multiple switchboards for 12,600 lines; the installation of automatic meters in the Paris exchanges; and the laying down of long-distance subterranean lines.

Ohio's Campaign of Education

How the Operators of the Biggest Independent Company are Being Trained

BY MAE A. MARION

IN the interchange of messages between plants it is absolutely essential to eliminate line waste as well as waste in the time element in which the messages are transmitted and received. To eliminate the waste and consequent inefficient service in long distance work, a system is found to be necessary, because without system there could be no perfect efficiency.

Before there can be perfect system, uniformity must be found and put into operation. Before there can be perfect uniformity in service there must be co-operation of all the plants and managers. Without this co-operation, the building stone of system and efficiency will have no foundation.

For the purpose of co-operation, uniformity and efficiency, a campaign of education was inaugurated by the Ohio State Telephone Company, and to bring about the necessary education in our work a school was established.

The Ohio State Telephone Company wishes to educate the operators and in turn the operators will educate the public. It is the company's aim to improve the service, and in order to do this we have opened the way to make this possible. In taking up this work we all started in as beginners.

If there were but one message to handle at a time and the persons to talk were to choose just that time for attention upon the telephone, operating rules could be reduced to very few words. Complications are such that pages of instruction must be multiplied.

The groundwork for an operator's education is the single, simple call with its variations, as influenced by the desires or circumstances of the parties who are to talk. Then come the different conditions brought about by interference on the circuit. The possible varieties of all these are so great, and so many decisions must be made and actions taken quickly, that it is important to have full knowledge of methods, principles and practices.

To meet the growing complications, the company is putting into form for general adoption many practices which have been developed in the work or by study of the requirements of the work, in addition to systematizing methods now well understood among the operating employes. Among these are a more uniform method of dealing with delays, a systematic follow-up plan, a set order for handling business over established circuits, standard calls and relay orders, supervisory notations, improved tickets and additional code symbols and standard phrases. The foundation is practically the same. The additions are in the direction of supplying shorter and more direct phrases between operators; better understanding by each operator of what may be expected from others; better safeguards over promptness and quality of service, to the end of attracting more calls and getting them over the busy circuits with less effort. The company is endeavoring to bring more fully to the appreciation of each operator that all tickets are as important as her tickets; that these tickets are not slips of paper but persons, each with a lively interest in the outcome of a call; that the purpose is to please these people and to increasing their number. The easiest way for an individual to perform any act frequently repeated is through the habit of following always the same process, and this is what we are teaching in our schools. It is well understood that rules alone cannot make service. Besides all the conditions described, peculiar circumstances will arise which are not to be met by rules or habits of action. Most of them, however, can be well met by good habits of thought or of feeling. The greatest help in the understanding and application of rules or in the treatment of cases beyond the rules, is the habit of courtesy and the continuous exercise of the human sympathy which underlies courtesy. The interest the operators have shown in Columbus has been very encouraging; they all seem very anxious to learn the new methods. I took a written examination two weeks ago. It certainly was remarkable; a number of the girls reached the 100 mark. One young lady employed as a B operator had never been in an operating room. She came to me after her first lesson and said: "Why, Miss Marion, this is all Greek to me." I told her after she had attended school awhile she would forget about not knowing anything about long distance work; that in our schools we intended to teach all alike. I felt sure in due time she would have the idea and knowledge. This young lady studied very hard when it was time for examinations; she was one of the girls that received 100. She is now learning to be a long distance operator. So you see, where there is a will there's a way. When the new rules have been enforced all over the state and out of the state, you will all wonder why you didn't see the need of the improvement years ago. I would like to read you a few expressions from the operators who have attended the schools:

1. So far as I, as an individual, am concerned, I certainly feel that the knowledge I have derived from the present school of training, has much increased by frail ability as a pay station operator. And from my own experience, I find the work easier after having placed it in practical use, and am quite sure when the entire state has uniformly adopted this perfected system of codes and abbreviations, it will raise the new high standard of the Ohio State Telephone Company to a much greater height than its present owners and officers are now enjoying.

2. Benefits I have derived from the school—
   Clear understanding of just what is expected of operators.
   How to pass a call intelligently.
   Habit of using code symbols in giving reports, thus reducing circuit waste and increasing the capacity of the lines.
   Inspiration to become a more efficient operator.

3. I find the operators' school very beneficial. It is a greater pleasure to work with each one performing her duties in a uniform way and all willing to help one another; also to feel that the other operators consider my calls as important as their own. When passing a call order or relay to a terminating station we feel sure it will receive as much attention as our own calls, making it easier for each one. When all stations concerned co-operate in a uniform way it will make it easier for all.

4. Generally speaking, there has been a marked improvement among our operators since the opening of the operators' school. Many important topics were discussed which could not be given special attention in the operating room. Each operator has entered the work with enthusiasm and a willingness to co-operate, thus benefiting our own office and the distant office as well.

5. By your careful and splendid way of explaining and teaching, I have been promoted from B operator to line operator, and I owe all of my success to you. Your lessons have been very beneficial to all operators for they have shortened our work and enabled us to work together—team work. You have also

taught me courtesy, accuracy, and above all how to work on the toll boards, for which I am very thankful to you.

If my remarks have been in the least degree of an influential nature to bring to your minds the realization of the necessity for our school and the results of a better business efficiency, logically and naturally resulting therefrom, then my opportunity has not been wasted. The day has come when our business, to be in step with the progressive strides of big business generally, must be made uniform and efficient. If my remarks have been productive of any belief in your minds in our work, then I shall be happy and contented. Get together; work together, and I feel confident that everything good and right will come to all of us.

Iowa Convention Attracts Crowd

The twenty-first annual meeting of the Iowa Independent Telephone Association, held on March 14, 15 and 16, at the Chamberlain Hotel, Des Moines, was a record-breaker for attendance. From 150 the first day to 350 members at the last meeting marked the rise in enthusiasm which made the sessions the best in the history of the association.

The plant school which was a strong attraction for the delegates was held at ten in the morning, before the regular session. It was in charge of G. L. Saunders and W. L. Agee, of Grinnell, A. B. Campbell and C. A. Wright, of Ames, all of the Iowa State College, who discussed cable structures, layouts and plans, switchboard installation and testing, trouble shooting and transmissions. A school for operators was held Tuesday and Wednesday by Miss T. Anne Barnes, telephone instructress, also of Iowa State College.

The first session was opened at two on Tuesday afternoon by President H. B. Shoemaker, of Toledo, who then appointed members Beyer, Wilson and Saunders as a committee on resolutions and members Atkinson and Tragen on auditing; and Plaister, Reed, Graves, Van Vliet and Wells on the nominating committee.

The president's annual speech then followed in which he brought out the strong necessity of co-operation between the Independent operator and Independent manufacturer, for their life existence. After dilating on the subject he brought out the fact that the public regarded them as robbers and then said: "What can we do about it? We can do a great deal. Each of us is a molder of public opinion in his own community. We must create sentiment by word of mouth, by pen, by conduct of business, and in every way possible to dispell the spirit of antagonism and injustice to our business."

F. C. Builta of Omaha then spoke on "Preparedness." As he so aptly put it, "Publicity is preparedness, a matter of insurance in public utility work." After reviewing the changes of the last five years in the industry in Iowa and the benefits of the telephone, he, too, took up and drove home facts about the necessity of educating the public to be fair to the industry.

Charles C. Deering then was called upon for his report as secretary-treasurer, during the past year. E. H. Martin then presented his paper on "Metered Service," which caused considerable discussion as to the practicability of telephone meters. This ended the session for the day.

The evening entertainment proffered by the Des Moines Chamber of Commerce to the members was a snappy display at Ryan's gymnasium of wrestling and boxing.

Wednesday morning the convention was called to order by Secretary C. C. Deering who introduced the secretary-treasurer of the United States Independent Telephone Association, who addressed the members on the "Value of Association Work." He stated that not only publicity campaigns may be conducted but also educational work which for example resulted in changing the Federal war tax on messages from the companies to the subscriber.

The governor of Iowa, George W. Clarke, was then introduced by President Shoemaker. He gave us a good address and in closing stated he thought there was no end as to what might be accomplished in the telephone field. Vice-President F. B. MacKinnon, of the U. S. Independent Telephone Association, gave the last address of the morning on "Government Ownership." It created a great deal of comment.

In the afternoon Secretary Deering read H. G. Addie's paper on "Merit Service," which described a new individual merit system for paying operators a bonus, which was very successful in operation. A different system based on team work bonuses was then discussed by M. A. Reed in which the operators are paid a four per cent bonus for answering calls in an average of six seconds, seven percent on an average of five seconds and a ten per cent bonus for an average of four seconds.

After the discussion Carl Kuehnle spoke on "Standards of Service." P. C. Holdoegel followed with an introduction by President Shoemaker as "Senator Holdoegel." He stated that to his knowledge over 98 percent of the 225,000 telephones in Iowa were grounded and this answered the high tension and power advocates that such lines were not standard, as it would be a hardship and double the entire transmission expense of the state if a return wire was necessary to avoid interference. He made quite an appeal for new members to help combat this evil.

Harold L. Beyer then told of "High Tension Line Interference," saying that there should be a single state board of control, in his opinion for franchises and construction, thus doing away with local boards of supervisors. The state association, he said, should be a clearing house for action regarding transmission companies.

At the close of his talk the nominating committee made its report and the following officers were elected for the year:

H. B. Shoemaker, Toledo, president.

Charles C. Deering, Des Moines, secretary-treasurer.

Executive committee, President Shoemaker, George E. Atkinson, D. W. Wannhardt, J. M. Plaister and J. H. Denkhoff.

In the evening the members of the convention attended a splendid theater party at the Princess theater.

Thursday morning some two hundred members attended the hearing of the Iowa Railroad Commission at the State House, relative to high tension interference, which lasted until 5:30 Saturday night when the commission adjourned until 10 a. m., April 3, which session closed the convention.

The convention was productive of the best of results and every member left feeling he had achieved some good in coming, and left firmly convinced of the need of co-operation.

Sensitiveness of women hard of hearing often keeps them from using an ear trumpet, especially in public places. A new style handbag contains the necessary batteries and receiver for a telephone outfit so that the only obvious indication of the use of the instrument is the receiver, which is small and can be easily held in the hand, and the cord.

MINNESOTA TELEPHONE NEWS

BY THE MINNESOTA INDEPENDENT TELEPHONE ASSOCIATION
326 McKnight Bldg., Minneapolis, Minn.

A CONFERENCE was held in the office of the Railroad and Warehouse Commission, on March 15, between the representatives of the railroad companies and telephone companies, relative to telephone service in railroad depots, and was followed by a discussion of other questions relating to telephone regulation and complaints which the commission has recently received. There was a large attendance of both the railroad and telephone companies, including the following:

Soo Line, E. F. Potter, assistant general manager; C. B. & Q., Barrows, Stewart & Ordway, attorneys; M. & I., W. H. Gemmell, general manager; Omaha, A. W. Trenholm, general manager, George Boyce, superintendent of telegraph; Great Northern; C., M. & St. P., A. C. Adams, assistant superintendent of telegraph; C., R. I. & P., M. V. Seymour, attorney, C. H. Hubbell, superintendent of telegraph; Northern Pacific, D. R. Frost, attorney, M. H. Clapp, superintendent of telegraph, Newman Kline, superintendent; C. & G. W., J. W. Mulhern, superintendent; Duluth & Iron Range, H. Johnson, auditor; Northwestern Telephone Exchange Company, M. L. Lane, commercial superintendent; Tri-State Telephone Company, D. M. Neil, commercial superintendent; Worthington Telephone Company, Worthington, J. A. Cashel, attorney; Fulda Telephone Company, Fulda, F. D. Lindquist, secretary-manager and F. R. Geyerman, director; Webster Farmers Company, Lonsdale, J. J. Barrett; Dassel-Collinwood Company, Dassel, Olof Anderson, secretary-manager; Farmers Mutual Company, Emmons, K. N. Tror; Bellingham Company, Bellingham, L. F. Clark, president; Melrose Company, Melrose, A. E. Kraker, owner; Chisago City Company, Chisago City, J. E. Vanstrom, manager; Garden Valley Company, Erskine, Thomas Vollom, manager; Farmers & Merchants Company, Garfield, J. S. Wagner, secretary; Watkins Telephone Company, Watkins, M. J. Konshak, owner; South Haven Company, South Haven, F. R. Miller, manager; Blue Earth Valley Company, Blue Earth, D. W. Gretorex, secretary and treasurer; McLeod County Company, Glencoe, Jay Greaves, president; Hewitt Exchange, Hewitt, C. C. Bohn, manager; Wendell Company, Wendell, T. A. Boyd, manager; Wright County Company, Waverly, Wm. Quinn, president; Watertown Company, Watertown, Levi Johnson, secretary-manager; Hutchinson Company, Hutchinson, W. S. Clay, manager; Bertha Company, Bertha, W. Bluhm, secretary; Halstad Company, Halstad, G. O. Benson, secretary; Kenyon Telephone Company, Kenyon, Jos. A. Gates, president; Minnesota Telephone Association, Minneapolis, E. C. Kast, exchange agent.

J. A. Cashel of Worthington assisted by E. C. Kast called several of the telephone companies present to give information as to why it was necessary to have telephone service in the depot. The railroad companies also explained their position and stated that there was no question but what the telephone in the depot was a public convenience as well as a necessity. The matter of who should pay for this service and under what classification, was the main point at issue. The commission after hearing from both sides took the matter under advisement and a decision or ruling can be expected in a short time.

At the afternoon session the following questions were discussed, which the commission had prepared:

1. Classification of service where the place of business and the residence of a subscriber are in the same premises.
2. Classification of service to a doctor whose office is in his residence and who has no down-town office.
3. Preferential rate to stockholders.
4. Uniform switching charges to connecting rural lines.
5. Rates to be paid by subscribers on rural lines connected with two exchanges.
6. "Other line" charges over rural lines.
7. Disconnection of the lines of connecting rural companies because of non-payment of the switching charge by one member on the line.
8. Discontinuance of service and removal of telephone for refusal of payment in advance where payment in advance is a regulation of the company.
9. Special rates under contracts which have expired and under contracts not expired.
10. Free interchange of service between companies.
11. Mutual companies.
12. Map records of plant.

The telephone companies present were not all of the same opinion as to answers to the above questions, but from the information obtained, it is expected that the commission will issue a general ruling covering all the questions within the near future.

We are informed by the Railroad & Warehouse Commission that the 1915 annual report blanks and forms will be sent to all telephone companies about the first of April.

IN THE MATTER OF THE APPLICATION OF THE LONG PRAIRIE TELEPHONE COMPANY TO INCREASE ITS LOCAL EXCHANGE RATES AT LONG PRAIRIE, MINNESOTA.

This application was heard before the commission on the 28th day of September, 1915, the telephone company being represented by Joseph Kraker, its secretary and manager, and the citizens of Long Prairie by A. D. Day, president of the village council.

Subsequent to the hearing the commission caused an examination to be made of the books of account, records, and physical properties of the company, and the reports have been filed with and have been made a part of the record in this case.

Upon examination of all of the facts, the commission finds that the Long Prairie Telephone Company has a capital stock of $15,000.00, all but certain qualifying shares being owned by Joseph Kraker. It operates a local exchange at Long Prairie, and the line from Long Prairie to Browerville, a distance of nine miles. The exchange connects with eighteen rural lines owned by the Leslie Rural Telephone Company, which has about 380 rural stations. The Long Prairie Telephone Company has 265 subscribers.

Mr. Kraker bought the plant on January 1, 1912, for $6,700.00. Extensive reconstruction was carried on in the summer of 1915, which was due to an agitation on the part of the citizens at Long Prairie for an ornamental lighting system on the principal business streets where the pole lines of the company were located. The plant on these streets was not in good condition, the service of the exchange being what is known as "grounded common return." Because of this fact the company removed its pole lines and wires from portions of the principal business streets, placing them on streets and alleys to the rear, using aerial lead covered cables instead of wire. In the reconstruction work about 8,378 feet of aerial cable was placed, and in many cases old poles on old routes maintained were replaced with new poles; also within the districts served from the aerial cable all of the old subscribers' drop wire was replaced with new drop wire and the inside wire to the subscribers' telephones was also renewed in this district. The old central office equipment was replaced with new magneto equipment of the latest type.

The physical value of the property is found by the

commission to be $11,976.79. An examination of the records show that the books contained no capital account, no balance sheet, and, in fact, were a loosely kept and partially unkept set of single entry accounts. From the information available a segregation was made by the commission's statistician of all earnings and expenses for the years 1912, 1913, 1914 and for seven months ending July 31,1916. The net corporate return has steadily decreased, which is accounted for by the constantly increasing salary of the manager, miscellaneous account, and purchase of materials for maintenance purposes. The net corporate income for 1912 was $1,957.86, for 1915, $425.75, for 1914, $310.67, and for seven months ending July 31, 1915, $60.39. No depreciation was charged during this period, and if it had been done there would have been no surplus for the years 1913, 1914, or first seven months in 1915.

In considering a reasonable rate for this plant it is necessary to determine the approximate operating expenses and depreciation allowance; based upon the experience of the company, and the obligation to give good service and properly maintain the plant, the commission is of the opinion that $4,800.45 will be ample. In the calculation nothing is allowed for material on hand, because at the present time the company has supplies to the amount of $1,023.77.

The petitioner makes application to place the following rates into effect:

1-party business		$2.75	per month
2-party business		2.25	" "
1-party residence		1.75	" "
2-party residence		1.50	" "
4-party residence		1.25	" "
Business extension	net	.25	" "
Residence extension	net	.25	" "

A discount of 25 cents to be allowed from the above rates if paid on or before the 15th of the month in which the service is rendered.

The present rates charged by this company are as follows:

1-party business		$2.00	per month
1-party residence	net	1.00	" "
2-party residence	net	1.00	" "

The subscribers are billed 25 cents additional to the above rates, which is allowed as a discount if paid on or before the 15th of the month in which the bill is rendered.

The commission believes that the present rates will not yield a sufficient return upon the fair value of the property. The schedule hereafter suggested by the commission is declared to be a just and reasonable rate and classification for service rendered at Long Prairie:

Business 1-party		$2.75	per month
Residence 1-party		1.50	" "
Residence 2-party		1.25	" "
Business extension sets	net	.50	" "
Residence extension sets	net	.25	" "

A discount of 25 cents per month to be allowed from the above rates if bill is paid on or before the 15th day of the month in which the service is rendered.

It will be noted that this gives a net increase of 50 cents per month on the business and 25 cents per month on one-party residence and no increase upon a two-party residence telephone, provided the subscriber pays his rent on or before the 15th day of the month in which the service is rendered. The probable earnings under the rates here suggested will be $5,502.00 for the ensuing year. Taking therefrom the operating expense and depreciation of $4,800.45, there is to be found a net return of $701.55, which is equivalent to a return upon the valuation of the property as found by the commission of 5.857 per cent. In this particular case the commission is willing to allow a depreciation of 8.938 per cent based on the valuation of the property. This item is obtained from the best available information which is on hand at the present time. It does not preclude this commission from reaching a different result for this or any other telephone plant in the state. A considerable portion of this plant is quite old and is an open wire construction, which from now on will depreciate very rapidly.

At the hearing some complaint was made about the poor service upon farm lines connecting with the Long Prairie telephone plant. A personal investigation of the plant serving the farm lines was made and it was found that the portion of the farm line plant within the exchange is in good condition, and that the connections and service from the switchboard is good and that the operators pay particular attention to the farm line service. An inspection was made of some of the farm lines and about twenty farmers were called upon outside of Long Prairie, and it was found that while the telephone lines themselves were in a reasonably fair condition, the wiring from the line to the telephone, particularly that portion termed as "inside wiring"—that which connects the telephone with the outside plant—was in poor condition. Eight poor connections were found at one station and at every station inspected there were several such loose connections. Under these circumstances, it would not be reasonable to hold the Long Prairie Telephone Company responsible for the poor service that the farmers are now receiving or that the local subscribers receive when connected with the farm lines.

NO COMPANY CAN EXTEND ITS LINES AND INSTALL TELEPHONES FOR LOCAL SERVICE INTO A VILLAGE WITHOUT THE CONSENT OF THE COMMISSION, WHERE THE SWITCHBOARD OR EXCHANGE HAS BEEN ESTABLISHED JUST OUTSIDE THE CORPORATE LIMITS OF SUCH A VILLAGE.

J. W. Howatt, Supervisor of Telephones:—You inquire if a telephone company can construct an exchange outside the limits of a village in which an exchange is furnishing service to local subscribers, and, without the consent of the commission, extend its poles and wires and also install telephones within said village for the purpose of giving local service therein.

This question has been considered by the commission and I am authorized to answer your inquiry in the negative. Section 13 of the Telephone Act reads as follows:

"No local telephone exchange shall be constructed or installed in any city or village for furnishing local service to subscribers in such village or city, where there is in operation in such village or city a local exchange already furnishing such service, without first securing from the commission a declaration, after a public hearing, that public convenience requires such second telephone exchange."

The law contemplates that telephone companies shall be controlled by state regulations rather than by competition. Duplication of service is not favored. Where an exchange is furnishing local service within a village no competing company will be permitted to operate therein without a finding by the commission that public convenience requires a second telephone exchange. A local telephone exchange is the telephone apparatus employed and necessary to furnish service between subscribers within a village. The ability of subscribers to talk with each other within the village is the test, and therefore it follows that the office or switchboard need not be located within the village. If a switchboard or local office is established just outside the village limits and is then permitted to extend its poles and wires and install telephones within the village and engage in performing local service, the purpose of the law would be destroyed and no protection could be given by the state to the existing exchange. This case is supported by the case of Citizens Telephone Company of Eau Claire before the Railroad Commission of Wisconsin, Commission Leaflets 23 to 26, page 473.—C. E. Elmquist, Commissioner.

PERMISSION GRANTED THE ALVARADO TELEPHONE COMPANY OF ALVARADO TO PURCHASE THE LOCAL EXCHANGE AND RURAL LINES FROM THE WARREN TELEPHONE COMPANY OF WARREN.

The commission considered the application of the Alvarado Telephone Company in which it asks permission to purchase from the Warren Telephone Company of Warren, the local telephone exchange in the village of Alvarado, together with the rural lines of the Warren Telephone Company connected with the Alvarado Telephone Exchange.

The commission finds that the number of telephones affected by said purchase is 39, of which 21 are located within the village limits of Alvarado and 18 on the rural lines. That the stockholders of the Alvarado Telephone Company have agreed to purchase the telephone lines and exchange of the Warren Company and that the Warren Company has consented to the sale for the sum of $1,200.00; that the transfer of the property will in no way affect the rates of other lines connected with the Alvarado Company to perform such reconstruction and make such extensions to the plant as are necessary to improve the service and give the subscribers of said exchange a much better service than they now enjoy.

The commission authorized the Alvarado Telephone Company to purchase the local telephone exchange, together with the rural lines connected therewith from the Warren Company of Warren.

IN THE MATTER OF THE APPLICATION OF THE NORTHWESTERN TELEPHONE EXCHANGE COMPANY TO INCREASE ITS LOCAL EXCHANGE RATES AT GLENWOOD, MINNESOTA.

Application has been filed by the Northwestern Telephone Exchange Company, in which it is alleged that it has recently reconstructed the outside plant and installed the necessary subscribers and exchange apparatus, converting the exchange from a magneto to a common battery service system, and in order to secure a reasonable return on the investment, it is necessary to inclease its local exchange rates as follows:

PRESENT RATES.

Individual line business	$2.50	per month
Individual line residence	1.50	" "
Two-party line residence	1.25	" "

A discount of 25c per month is allowed if bill is paid at the company's office on or before the 15th of the month in which it is rendered.

PROPOSED RATES.

Individual line business	$2.75	per month
Two-party line business	2.50	" "
Individual line residence	1.75	" "
Two-party line residence	1.50	" "
Four-party line residence	1.25	" "

A discount of 25c per month is to be allowed if the bill is paid at the company's office on or before the 15th of the month in which it is rendered.

A hearing was fixed to take place in the Court House at Glenwood, on the 28th day of March at 9:00 o'clock.

TRI-STATE COMPANY REDUCES TOLL RATE BETWEEN LONG LAKE AND THE TWIN CITIES.

Application was filed with the commission February 7, by the Tri-State Telephone and Telegraph Company, asking permission to change or reduce its toll rate between Long Lake and the Twin Cities, from 25 cents for three minutes and 5 cents for each additional minute, to 15 cents for three minutes and 5 cents for each additional minute, on account of the business between these stations becoming more of a suburban business between Long Lake and Minneapolis.

The commission on February 16 granted the request asked for, effective March 1, the rate being subject to change upon complaint or investigation by the commission.

OWATONNA PHYSICAL CONNECTION CASE.

The Railroad and Warehouse Commission ordered another hearing, in the petition of the City of Owatonna to compel the Northwestern Telephone Exchange Company and the Tri-State Telephone and Telegraph Company to connect their toll lines at Owatonna, to be held in the City Hall at Owatonna on the 20th day of March at one o'clock.

IN THE MATTER OF THE APPLICATION OF THE OSAKIS TELEPHONE COMPANY TO INCREASE SWITCHING CHARGES TO THE LESLIE RURAL TELEPHONE COMPANY.

Application has been filed by the Osakis Telephone Company of Osakis, Minnesota, in which it asks permission to increase the switching rate now charged the Leslie Rural Telephone Company from 15 cents per station per month to 25 cents per station per month for such of the subscribers of the Leslie Rural Telephone Company as can call Osakis direct; also to charge a rate of 5 cents per message originating with subscribers on the lines of the Leslie Rural Telephone Company who cannot call Osakis direct, but who call through a switching point on the lines of said company, the application being made for the purpose of making the switching charges to all rural companies connecting with the exchange of the Osakis Telephone Company uniform, other rural connecting companies now connected with the exchange of the petitioner being 25 cents per month per telephone. A hearing took place at the office of the Railroad and Warehouse Commission on the 17th day of March at 10:00 o'clock.

IN THE MATTER OF THE APPLICATION OF THE NORTHWESTERN TELEPHONE EXCHANGE COMPANY TO PURCHASE THE MAJORITY OF THE STOCK OF THE CITIZENS TELEPHONE EXCHANGE OF MONTEVIDEO, MINNESOTA..

Application has been filed by the Northwestern Telephone Exchange Company of Minneapolis, asking for permission to purchase the majority of the stock of the Citizens Telephone Exchange Company of Montevideo, Minnesota, in which it is alleged that the stockholders of the said Citizens Telephone Company are ready and willing to sell, transfer and deliver to the petitioner the majority of said stock.

A hearing was held before the commission at its office in the State Capitol, on Friday, the 3rd day of March, at 10:00 o'clock. The Northwestern and Citizens Companies were represented. C. B. Randall, secretary and attorney for the Tri-State Telephone Company, was also present and argued against the sale.

ASSOCIATION NEWS ITEMS.

MISSION: At a recent meeting of the Farmers Club the matter of putting in a telephone line in the vicinity of this place was considered. It was estimated that the cost for such a line would be about $30 per telephone.

PARK RAPIDS: The Park Rapids and Straight River Telephone Company at a recent meeting elected the following offi-

cers for the ensuing year: President, P. D. Winship; vice-presidents, Ed. Resch and Ed. Shubert; secretary, E. W. Tilton.

ALEXANDRIA: The Alexandria Company has recently let constructions for a new central energy switchboard and telephones and which will take the place of the present equipment as soon as the work can be done this spring. It was also understood that the exchange will be located in a new building. The improvements will cost approximately $30,000.

TRUMAN: At the annual meeting of the stockholders of the Armstrong Telephone Company, held in January, the following officers were elected for the ensuing year: President, E. L. Gove; vice-president, Lyman Batchellor; treasurer, C. F. Dahl. The Armstrong Company owns the Truman Telephone Exchange.

BERTHA: At a recent meeting of the Bertha Telephone Company it was decided to sell the exchange to Louis Bluhm.

NORTHFIELD: The Northwestern Telephone Exchange Company will spend approximately $20,000 on improving its local exchange. Underground work along Division street now is being taken care of.

ADRIAN: The West Side Telephone Company held its election this month and the following officers will take care of its affairs for the ensuing year: President, W. E. Taylor; vice-president, Valentine Kunkle; treasurer, Joseph Medboe.

BRUSH CREEK (Blue Earth): The Wells Brush Telephone Company at its recent meeting elected the following officers: President, Edward Buscho; vice-president, George Prange; secretary, Henry Hautt.

HARTLAND: At a recent meeting of the Manchester Farmers Telephone Company it was decided to install a new switchboard at Hartland.

WELLS: The Star Telephone Company at its annual meeting a few days ago elected the following officers: W. L. Bates, president; John Rickard, vice-president; H. E. Brandt, secretary.

DALTON: The annual meeting of the Park Region Telephone Company has just been held and the following officers were elected: President, M. N. Hovang; vice-president, Theo. Sjordahl; secretary, Henry Hoff.

WARD (Long Prairie): The West Ward Telephone Company recently held a meeting and decided to run its own line into town in preference to joining the Ward and Moran Companies.

GREENLEAF: The following officers were recently elected at the annual meeting of the Greenleaf Telephone Company: President, N. Barrick; vice-president, Frank Welch; treasurer, Charles Palmer.

HALSTED: The Halsted Telephone Company has bought the building that is used for the switchboard.

DULUTH: The Alborn Telephone Company is planning to extend its line in the spring.

AMBOY: The Willow Creek Telephone Company held its annual meeting recently and elected the following officers for the ensuing year: President, J. R. Winch; vice-president, T. M. Schwary; secretary, J. W. Hentage.

NEW ULM: The New Ulm Rural Telephone Company plans to erect a modern telephone exchange on 2d N. and German streets soon.

WEST CONCORD: The Mutual Telephone Company recently held its annual meeting and the following officers were elected for the ensuing year: Frank Vanderhyde, president; J. J. Casin, vice-president; Geo. Wright, secretary and treasurer.

WIRT: A telephone service will be installed at Wirt and Stanley in the near future. The poles are to be erected soon and the line will connect with the central office at Bigfork.

FERGUS FALLS: Articles of incorporation have been filed for the Fergus Falls and Jewett Lake Rural Telephone Company, with a capital stock of $1,500. Incorporators are, W. B. Chapin, P. J. Dohrer, and others.

ST. PAUL: The Tri-State Telephone Company is erecting a new building, for the East exchange, at 650 York street, which is nearly completed. The cost will be $30,000.

NEW FOLDEN: Otto Thompson is interested in a new telephone line which is expected to be built next summer.

THIEF RIVER FALLS: City Attorney Quale will petition the State Railroad Commission for a physical connection between the N. W. and Tri-State Telephone Companies.

ERIE: On account of the farmers being desirous of having telephone service, a line is being extended from Erie to Neptune.

RUSHFORD: The Farmers Home Telephone Company recently held its annual meeting and elected the following officers for the ensuing year: President, John Holgar; vice-president, John Fossen; secretary, O. S. Evenson.

NEW YORK MILLS: The Heinola Telephone Company recently had a meeting and voted to build new lines.

CROW WING: Members of the Crow Wing Farmers Telephone Company held a meeting recently and decided to incorporate.

HOLT: At the annual meeting of the Holt Telephone Company, recently held, the following officers were elected: M. Grondahl, president; A. L. Carlson, treasurer; John A. Sorum, secretary.

HENDRUM: At a meeting of the Hendrum Telephone Company, continuous service was decided upon.

KARLSTAD: The Donaldson-Karlstad telephone lines have been sold by A. O. Blomsness to a company composed of farmers.

FOY: J. O. Anderson of Foy has organized a farmers telephone line to connect Kelliher with the Red Lake peninsula.

ELM DALE: At the annual meeting of the Elm Dale Telephone Company, held recently, the following officers were elected: President, A. Martinson; vice-president, John A. Erickson; secretary, J. J. Jacobson.

HERMAN: A new switch will be installed at the central office here in the near future.

STEWARTVILLE: At the recent annual meeting of the Telephone Company at Vernon, the following officers were elected for the ensuing year: T. C. Thorsen, president; Ole Benson, vice-president; and A. S. Berget, secretary.

COOK: The Cook & Vermillion Telephone Company recently held its annual meeting and elected the following officers for the ensuing year: Charles Larson, president; Fred Anderson, vice-president; Oscar Swedberg, secretary.

WEST DULUTH: Petitions are being circulated among business men of West Duluth, asking the Northern Pacific Railroad to install a Zenith telephone at its passenger station in West Duluth.

HAYFIELD: At the annual meeting of the Telephone Company at Vernon, the following officers were elected: T. O. Thorson, president; Ole Benson, vice-president; A. S. Berge, secretary.

MENAHGA: The Menahga Western Telephone Company recently held its annual meeting and elected the following officers: President, A. P. Danielson; secretary, Anton Anderson; treasurer, Andrew Karjala.

FAIRMONT: H. P. Sentman has been made manager of the Fairmont Telephone Company.

CLEAR LAKE: At a recent meeting of the Farmers Telephone Line, the following officers were elected for the ensuing year: Frank Gosnner, president; Fred Sudtelgte, treasurer; Harry Campbell, secretary.

GRONIGEN: After a great deal of effort on the part of the farmers around here, a telephone line is assured.

CHISHOLM: The telephone proposition is being considered by the farmers of Balkan township.

CHOKIO: The Stevens Township Telephone Company held its annual meeting recently and the following officers were elected: R. W. Keeler, president; H. H. O'Brian, vice-president; Fred A. Carlson, secretary.

ALBANY: The Route 2 farmers of Albany have started an organization to build a new telephone line from Albany along their route. Christ Fuchs will be manager.

LAKEFIELD: Fritz Schutdt has been elected president of the Rost Telephone Company, in place of John Grussing, who resigned.

WALKER: The office of the Telephone Company will be enlarged. The company is planinng an all-night service.

ELLENDALE: The Ellendale Rural Telephone Company recently held its annual meeting and elected the following officers: W. B. Wardwell, Andrew Gregerson, and E. M. Thompson.

WARROAD: The telephone line is to be extended from the America line to the Clear River post office in the near future.

CASS LAKE: A meeting was held the first part of March for the purpose of organizing a rural telephone line to cover the territory north and west of Cass Lake as far as Wolf Lake.

ALBANY: A telephone company has recently been organized at this place to build a farmers line in the spring by J. C. Schwinghammer, Martin Falkner and Joseph Tomsche.

LINCOLN: The Lincoln Rural Telephone Company has just held its annual meeting and elected the following officers: President, William Goerndt; secretary and treasurer, F. A. Swain.

SPRINGFIELD: After April the first, Bert Dunn, the present manager of the Farmers and Citizens Mutual Telephone Company of Springfield will be with the Tri-State Telephone Company, in charge of the southwestern part of the state. Mr. Dunn has been connected with the local company for about ten years. It is understood that he will make his headquarters at Springfield.

ST. PETER: At the recent meeting of the Nicollet County Telegraph and Telephone Company of St. Peter, C. C. Nelson, the vice-president, was elected general manager of the company. Mr. Nelson takes the place of C. W. Carpenter in the active management. Mr. Carpenter will continue as an officer of the company. This company has exchanges at St. Peter, Gaylord, Gibbon, Kasota, Nicollet, New Sweden, Lafayette, and Cleveland.

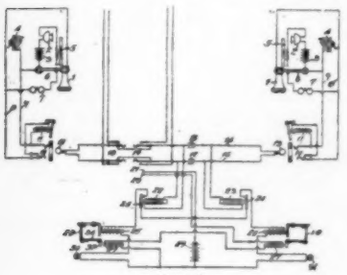
Telephone Patents Issued Recently

A Brief Digest of those Current Specifications Most Interesting to Telephone Men

BY DAVID S. HULFISH

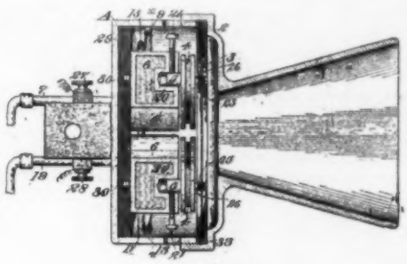
NOS. 1,164,625 and 1,164,626. Impulse Mechanism. Issued to A. H. Adams, assignor to Western Electric Company, New York, N. Y. Call sender for automatic telephone exchange in which the number is called by pulling the call sender once for each figure. The mechanism is so arranged that it may be set for a second figure before the sending of the first digit is completed.

1,164,662. Party Line System. Issued to G. E. Mueller, assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. (Application filed August 14, 1911.) The system is for an automatic exchange and provides a selector of ringing currents auxiliary to the final connection but operated by the same impulses as the final connector. Each line occupies as many sets of points in the final connector as there are stations on the line.



1,165,336.

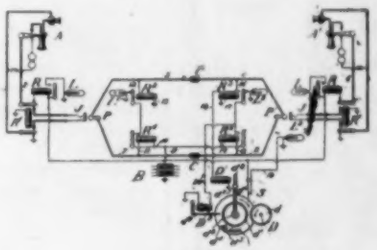
1,165,255. Transmitter. Issued to C. D. Herrold and E. A. B. Portal, San Jose, Calif. Several carbon cells are provided for one diaphragm and a water cell to cool the back electrode of each carbon cell.



1,165,255.

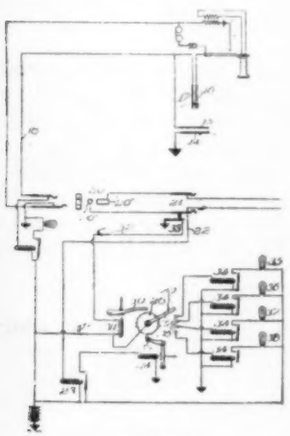
1,165,336. Telephone System. Issued to O. M. Leich, assignor to Cracraft-Leich Company, Genoa, Ill. A switchboard for local battery magneto lines. The cord circuits have relays rung by the hand generators, each of which trips a drop and light a lamp, the lamp being lighted only while the hand generator is being turned.

1,165,690. Trunking System. Issued to T. G. Martin, assignor to Automatic Electric Company, Chicago, Ill. (Application filed December 10, 1910.) When an automatic telephone calls through the automatic exchange to the manual toll-line board, the toll operator has power to release the connection. A two-way trunk is shown and claimed.



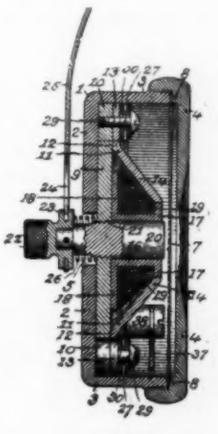
1,168,259.

1,166,090. Pay-Station System. Issued to A. J. Seymour, Minneapolis, Minn. The coin collector sends impulses over the line according to the size of coin. A ratchet at central is set by the impulses and a lamp then glows to indicate the size of the coin.



1,166,090.

1,166,152. Receiver. Issued to Thomas Rhodus, Chicago, Ill., assignor to the Magniphone Company. A hollow cone of magnetic metal outside the winding brings both poles of the winding near the center of the diaphragm.



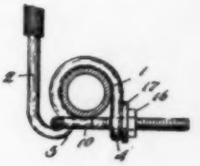
1,166,152.

1,166,466. Semi-Automatic Exchange. Issued to A. E. Lundell, assignor to Western Electric Company, New York, N. Y. Automatic devices are provided for pre-selection of connecting circuits and for associating a central-office callsender with each, the callsenders being released when a connection has been set up between two lines.

1,166,620. Callsender. Issued to J. H. Melvin, assignor to Automatic Electric Company, Chicago, Ill. (Application filed January 20, 1909.) A rotary dial and an impulse wheel are used. A claim is granted covering a dial which may be rotated initially only from its home position; that is, having been turned, it must return fully before being turned again.

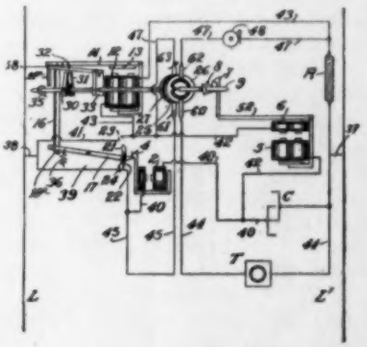
1,166,645. Party Line Lockout. Issued to B. D. Willis, assignor to Automatic Electric Company, Chicago, Ill. A relay at the telephone closes the talking circuit. If the line be busy the potential across the pair is too low to operate the locking-in relay. After conversation, the relay is unlocked by a magnet charged through an under contact of the hook lever.

1,167,053. Signal Control System. Issued to A. H. Dyson, assignor to Western Electric Company, New York, N. Y. A timing relay changes the circuit for signal impulses coming in groups from an automatic callsender. After the first impulse of a group is received, sufficient time is given for a maximum group.



1,167,378.

1,167,378. Ground Clamp. Issued to L. B. Buchanan, Woburn, Mass. The equipment other than the wire to be attached is a screw hook with nut and washer. The wire is bent sharply, the hook put over the bend, and the wire then is brought around the ground pipe and around the hook and clamped by the nut.



1,167,522.

1,167,522. Selector. Issued to W. C. Richardson, Boston, Mass. Stepping mechanism for selection at each telephone of a party line is operated by strong currents and a signal is rung by

a weak current. All mechanism is operative whether the receiver is on or off the hook.

1,167,646. Control System. Issued to F. R. McBerty, assignor to Western Electric Company, New York, N. Y. In an automatic exchange having power driven switches and using the system of revertive impulses for control, repeating relays are located at a selector so that a register may control selection by a selector beyond the repeating relays.

1,167,654. Phantom Loading Coils. Issued to A. H. Olsson and H. B. M. Pleijel, Stockholm, Sweden. In a phantom telephone circuit, a coil is placed in each physical line or side line, the coils being laid so that when excited by currents in the phantom adjacent core ends will be of opposite polarity.

1,167,872. Automatic Exchange System. Issued to F. G. Agrell, Stockholm, Sweden. (Application filed August 23, 1907.) This system uses selectively operated means common to a number of switching circuits.

1,168,259. Timing System. Issued to J. L. Wright, assignor to E. E. Clement, Washington, D. C. (Application filed October 15, 1908.) A motor shaft is always running. Each cord pair has a timing device and a magnet (energized when a connection is made) for causing the timing device to be driven by the motor shaft. A lamp signal shows the time limit of the timing device.

1,168,319. Semi-Automatic Exchange. Issued to A. E. Lundell, assignor to Western Electric Company, New York, N. Y. The operator's telephone set has a callsender in connection and may be connected to a calling line, manually or automatically. When the calling line has been connected to the desired called line, the operator's telephone and callsender are disconnected automatically.

1,168,419. Selector Switch. Issued to J. N. Reynolds, assignor to Western Electric Company, New York, N. Y. A line multiple extends in one direction and a trunk multiple extends in an intersecting direction, with switch springs at every crossing and a magnet per line and per trunk. When trunk magnet and line magnet are operated at the same time, the switch springs at the intersection engage and the circuits are connected.

1,168,894. Automatic Trunking System. Issued to F. Lubberger, asignor to Automatic Electric Company, Chicago, Ill. (Application filed November 29, 1909.) A manual operator may connect a calling line to a trunk, and the trunk then extended to a distant switchboard by automatic devices, but the trunk is automatically released and made free for service again wholly by the act of hanging up the receiver upon the calling line.

1,168,904. Party Line Telephone. Issued to Roy Owens, assignor to First Trust and Savings Bank, trustee, Chicago, Ill. (Application filed July 5, 1906.) When any telephone upon the party line is used, the earth connection is cut off from all the telephones upon the line. When used in connection with an automatic telephone exchange where the earth is used for signaling, this expedient prevents interference by any of the remaining telephones while any one telephone is using the line.

1,169,102. Call Recording System for Automatic Exchange. Issued to T. G. Martin, assignor to First Trust and Savings Bank, trustee, Chicago, Ill. (Application filed January 17, 1907.) The meter of the calling line is operated when the called line answers. The mechanism for accomplishing this result includes a differentially-wound relay associated with the calling line.

Public Utility Commission News

Reports Concerning the Activities of State Regulating Bodies in the Telephone Field

Indiana

THE long pending case of the Whitley County Telephone Company vs. the Farmers Mutual Telephone Company for a free physical connection of the various exchanges of the two companies, was heard further before the State Public Service Commission in the State House at Indianapolis, and some interesting points were brought out, though they do not change the case in its major portions. The case of the Churubusco Telephone Company vs. the Whitley County Telephone Company, demanding that the latter named company pay a toll of five cents on all calls to Churubusco, was again taken up but no decision was rendered.

The Farmers Mutual Company and the Churubusco Company were represented by Attorney B. E. Gates, Manager R. R. Scott, John Gates and H. W. Soest, of the Churubusco Company. Attorney W. F. McNagny represented the Whitley County Company, and the case was heard before Judge McClure. The matter has been under discussion before the commission and in the local circuit court for nearly a year and is still undecided.

The Churubusco company took up the question of tolls and again brought before the attention of the commission the fact that the Farmers company charges a five cent toll, while the Home, or Whitley County Company, gives the service free. The Whitley County Company again opposed charging toll, as it has done at all of the former hearings before the commission. Judge McClure discussed the matter at some length and stated that he would announce his decision at a later date. In case the appeal of the Churubusco Company is decided against the Home Company, patrons of both companies will have to pay toll to and from Churubusco.

At this further hearing, the Farmers Mutual Company, by its attorney, B. E. Gates, insisted that if the companies are physically connected, there should be a toll rate, and Mr. Gates stated that he is willing that his company connect up at once, if the commission authorizes a toll charge of five cents on each call. The Whitley County Company, through Mr. McNagny, refused to consent to a toll charge on the ground that the service ought to be free to the subscribers of both companies. Judge McClure did not render his decision at the time and he stated that it was the desire of the commission to do what was right by both companies and the public.

Joseph L. Reiley, secretary to the public service commission, states that the hearing before the commission of the petition for the merger of the Indianapolis Telephone Company with the New Long Distance Telephone Company and the New Telephone Company had been postponed until the accountants of the commission can complete auditing the books of the companies concerned. The hearing had been set for March 1.

The Farmers Telephone Company, Bicknell, which brought suit against the Home Telephone Company, which increased the monthly rate from 25 to 50 cents, was awarded the right to its former rate under a contract for twenty-five years. The service was cut off about two months ago when the Public Service Commission granted the increase. More than 200 subscribers were affected by the decision.

The Home Telephone Company of Elkhart is seeking an increase of rates before the public utilities commission. The Home Telephone Company seeks to establish a ten cent rate between Goshen and Elkhart. At present this service is free. Free service from Elk-

hart is now given to Edwardsburg, Adamsville, Osceola, Dunlaps, Bristol and also to the subscribers of the Goshen exchange.

In its petition for an increase of rates the officials of the company show that the line between Goshen and Elkhart represents an investment of $6,133 and that it only rceives compensation for messages originating at Goshen for South Bend and points beyond. Officials of the company also assert there are five metallic lines connecting these two cities, established on private highways paralleling the tracks of the New York Central railroad, and that smoke from locomotives damages the wires, thus increasing the cost of maintenance.

The Farmers Co-operative Telephone Company filed a petition with the Public Service Commission of Indiana for physical connection with the Commercial Telephone Company of Warsaw, Ind.

The Commercial Telephone Company contested the application of the Farmers Company on lack of organization and maintenance, poor and cheap construction and efficiency of service. The company forced the point that no corporation could be made a party to the destruction of its own property.

The commission ordered that the Farmers Co-operative Telephone Company shall, before physical connection is made, repair and improve its systems of telephone lines, poles, cross arms, pins and insulators, make all lines metallic, and supply substantial poles, set no less than three feet in the ground, and not more than one hundred and fifty feet apart, and where more than two wires are carried on poles, they shall be securely attached by means of cross arms, properly stayed, and to have pins and insulators, that all obstructions to the wire shall be removed to prevent contact, such as limbs of trees, or structures of various kinds. That all telephones shall be maintained in such condition of repair to the end that reasonably adequate and sufficient service may be rendered, and after inspection is made by the commission, it will issue its certificate of approval if found to be in satisfactory condition.

Physical connection shall be made and installed within ten days after the commission shall issue its certificate of approval of the conditions of the lines of the Farmers Co-operative Telephone Company, and the expense of making the physical connection shall be borne and paid for by the Farmers company.

California

Because of the rapid growth of the territory between San Mateo and Burlingame, the Railroad Commission has been asked by the Easton Development Association to readjust the telephone rates. G. A. Wilson, the commission's engineer, has arrived and began an inspection on the result of which will depend the commission' action in the matter.

Alabama

After a hearing which continued a greater part of March 14, the Alabama Public Service Commission has under advisement the petition of the City Commission of Birmingham for permission to appoint an examiner to examine the books of the Southern Bell Telephone and Telegraph Company to determine whether or not the company's profits and operating expenses in Birmingham will warrant a reduction in rates.

The commission gave attorneys for the city and company until March 25 to prepare briefs in support of their contention.

Idaho

The Pacific Telephone & Telegraph Company has written the public utilities commission that in order to satisfy the complaint against rates charged it is willing to put into effect a rate of ten cents for one minute and five cents for each additional minute on its toll line between Troy and Kendrick, or a rate similar to the one in effect in Latah Lewis and Nez Perce counties.

The city of Coeur d'Alene has filed with the commission its brief in the case against the Interstate Utilities Company. The case involves the rate and service of the telephone company. An estimated reproduction cost of the company's plant is included with this brief.

The Central Idaho Telegraph and Telephone Company has been granted permission to put into effect within three days after publication a new wire rate between Weiser and other points north of Council of 35 cents with excess rate of 3 cents.

The Mountain States Telephone & Telegraph Company in answer to a complaint filed before the public utilities commission protesting against a rate charged by that company for the transfer of money, stated to the commission it does not solicit the transfer of funds by telephone and therefore has never filed a schedule of rates covering it.

Illinois

Henry Zumdahl, Hiram DeWall, and Christ Gassmund of Forreston were in Chicago to appear before the Illinois Utilities Commission in regard to mutual telephone companies charging toll. It appears that the Polo Mutual Telephone Company has been charging toll and wants other mutual telephone companies to do likewise, which they are not inclined to do, hence the matter will be brought before the commission for adjustment.

The ruling of the commission providing for the sale of Inter-State Telephone and Telegraph securities to the American Telegraph and Telephone Company —parent of the Bell Telephone Company, was affirmed March 2 by Circuit Judge Creighton of the Sangamon county court at Springfield.

Edward Romberg, a minority stockholder of the Inter-State Company, which has its general offices in Aurora, is contesting in the courts the decision of the commission. He said that he would appeal to the supreme court of Illinois and to the United States supreme court, if necessary, to block the proposed merger. Mr. Romberg declared that the proposed merger would be in direct violation of the Sherman anti-trust law.

The Illinois State Public Utilities Commission has retained Arthur Kneisel of Chicago to check the field data taken by the engineers of the Central Union Telephone Company in their inventory and appraisal of the physical property at Peoria.

Iowa

Members of the Iowa Independent Telephone Association, who recently held their twenty-first annual convention at the Chamberlain hotel, Des Moines, appeared March 16 before the railroad commission to present their case against the interference with their lines of the high tension lines run parallel to them.

They undertook to prove that grounded line telephone service is practical and has been entirely satisfactory to farm subscribers in the past and before the interference of the high tension lines began.

The Iowa railroad commission will send to all Iowa telephone, telegraph and electric companies a set of questions relating to the construction and transmission lines on the public highways. The opinions of the experts will be used as a basis for the granting of franchises for electric lines in the country districts in the future.

Apparently the telephone and telegraph companies will put up a lively fight against permitting transmission lines to occupy the highways. The Association of Railway Telegraph Superintendents appointed a committee to appear before the Iowa board on March 16 at the hearing on this subject.

The commission says that the two important questions to be determined are: "Does the prior occupancy of a highway by any telephone or other electric line give such company a superior right to the use of said highway as to protect it against interference of a substantial character by a subsequent electric company of a similar or equal character, said subsequent company having no connection with public travel?"

The other question is: "If the said interference can be substantially eliminated at a reasonable expense, which company should bear the expense, the company originally occupying the said highway or the new company seeking a franchise?"

Kansas

Two new telephone companies were granted authority to do business in Kansas March 19 by the state public utilities commission. The Naponee Telephone Company, of Naponee, Neb., was granted authority to engage in the operation of a telephone utility in Phillips county, Kansas, and the Boicourt Mutual Telephone Company was authorized to transact business in Boicourt and vicinity.

Rates on the Whitewater Telephone Company lines will have to be boosted 25 cents a month for each telephone as a result of the recent sleet storm in Kansas, according to an application filed recently with the Kansas public utilities commission. In asking the increase in rates the company states that its properties were damaged more than $5,000, and without the increase in rates it cannot borrow money for the necessary repairs.

The Whitewater Telephone Company has about 800 subscribers of whom 600 are stockholders. At a recent meeting of the stockholders the application relates, a resolution agreeing to the 25 cent increase was passed unanimously.

Application of the Butler County Telephone & Electric Company to sell its exchange and toll lines to the Missouri & Kansas Telephone Company, otherwise the Bell, was filed March 16 with the Kansas public utilities commission. Hearing was held March 24 in the utilities' hearing room in Topeka.

The public utilities commission has authorized the sale of the Stockton Telephone Exchange to the United Telephone Company of Topeka. The plant recently was bought by A. T. Rogers, J. O. Wilson and C. L. Brown, who in turn have transferred their rights to the United Telephone Company. The commission also issued an order dismissing the complaint of the Overbrook Commercial Wire Company against eight rural telephone exchanges in Osage county. The complaint was dismissed at the request of the Overbrook Commercial, difficulties over toll service having been adjusted since the complaint was filed last fall.

Authority to issue $30,000 worth of capital stock has been granted the Emporia Telephone Company by the Kansas public utilities commission. The issue is to be turned over to A. J. Ayers and J. A. Jackson as payment in full, according to the commission's order, for the Howard and Severy telephone exchanges, to be taken over by the Emporia company. The commission declined to pass on the value of the two plants in making the order, but simply authorized the transfer and the bond issue.

After ordering the stockholders to pay the same rental charges as other subscribers, the Kansas public utilities commission dismissed the application of the Center Township Telephone Company, of Olpe, for permission to increase rates. After the application was filed, the commission went to Olpe and held a public hearing. There it was developed that stockholders were paying only 50 cents a month for telephones, while other subscribers were paying $1 rental. The commission ordered that this discrimination be stopped immediately, came back to Topeka and did a little figuring, and decided that with the additional revenue from the stockholders no increase in rates was needed.

Michigan

Officials of the Michigan State Telephone Company of Detroit conferred with city officials again on March 10 in an effort to reach some agreement relative to telephone rates. The state railroad commission had urged a compromise.

One concession the city might agree to, Corporation Counsel Dingeman said, was the existing contract provision whereby patrons on four-party lines may make but a limited number of calls without extra charge.

A possible agreement to accept metered service for business telephones at a rate less than the present flat charge of $72 a year was another concession discussed.

Another conference will be held later.

Three telephone company hearings and one hearing on an application to issue stock in a public utility company were held before the state railroad commission March 17.

In the case of the United Home Telephone Company on application to raise rates on country telephones from $12 a year to $15 and from $30 to $36 on Ludington city telephones, a continuance of two weeks

was authorized. A similar action was taken in the case of the Oceana Mutual Telephone Company on a like application. A sale of the Easton Telephone Company of Orleans, Ionia county, to Noddins Brothers Telephone Company of the same place for $7,500 was permitted.

A bitter attack on Prof. Edward P. Burch, city's expert in the telephone rate investigation, is made in a letter sent to the state railroad commission by Arthur von Schlegell, general manager of the Michigan State Telephone Company.

The letter, a copy of which has been sent to Harry J. Dingeman, corporation counsel, protests vigorously against further delay in the filing of the city's inventory of telephone property. Mr. von Schlegell criticizes Mr. Burch's methods and apparent objects severely.

That the entire object of the city's investigation is to delay and hamper the settlement of the rate problem rather than to do justice is the charge by the general manager.

"The action of the city's expert," says Mr. von Schlegell, "throughout the entire investigation is not the course designed to effect a speedy and just solution of the telephone rate issue in Detroit, but rather involve the entire issue in interminable delay and confusion to the detriment of the service in that city. This protest of the company is to the persistent departure of the city's expert from established precedents of courts and commissioners in rate cases and his pursuit of petty and inconsequential details, often entirely wrong from a technical standpoint or immaterial to the issue, with the result that the problems which have become so acute in the operations of this company have been lost sight of."

Mr. von Schlegell insists that the only outcome of Mr. Burch's policy will be endless delays.

Missouri

The Southwestern Telegraph and Telephone (Bell) Company was given permission by the Public Service Commission to put into effect April 1 a modified schedule of increased rates on St. Louis business telephones. The schedule will be tried for a year to determine whether under it the company can obtain the increased revenue it holds is necessary.

The modified schedule increases the unlimited service direct rate from $78 to $96 a year. Officials of the Bell Company went to Jefferson City and submitted a schedule calling for an annual rate of $108 a year for unlimited business telephones and for $45 the lowest annual rate on measured service.

The commission refused to approve the $108 rate for unlimited service and objected also to the private branch exchange rate as being too high. Chairman Atkinson of the Public Service Commission suggested a $96 rate.

Experts of the Bell Company estimated that the present rate schedule adopted would increase the revenues of the company about $105,000 annually. The commissioners found the company was entitled to this increase in revenue.

A previous schedule submitted by the company would have netted an annual increase of $157,000 in the revenue, but the commissioners said these rates were too high. The rates of residence phones are not changed.

The efforts of the Bell Company to obtain an increase in the business phone rates began about a year and a half ago and numerous hearings were held in St. Louis and Jefferson City.

Nebraska

Rural subscribers of forty-five telephone lines out of Fairbury, representing 400 patrons, have held a mass meeting and appointed one member of a committee from each line for an organized effort to resist the proposed $1.50 rate of the Lincoln Telephone & Telegraph Company.

The case is now before the railway commission, and a committee consisting of James Axtell, W. H. Joslin and O. R. Jones was appointed to present the farmers' side to the commission.

The state railway commission has granted the application of the Platte County Independent Telephone Company to revise its rates at Columbus and to issue $14,000 of additional stock to pay the purchase price of an exchange at Columbus owned by the Nebraska Telephone Company. The permission of the commission to revise rates is granted on condition the telephone company complies with a city ordinance requiring all telephone companies to place their wires underground, that the two plants and service be consolidated, and overloaded farm lines be reduced to not exceed ten subscribers on a line, and that the company maintain its accounts in the form prescribed by the commission.

Ohio

Experts from the Lima Telephone & Telegraph Company were in conference with the utilties commission over the value the state has fixed for the property. The company made a value of $904,726, while the state gave a value of $847,423. The commission will make a finding soon fixing the value, and the question of new rates will then be considered.

Announcement that permission has been obtained from the state public utilities commission to increase the capital stock of the Amherst Telephone Company from $25,000 to $45,000 was made at a meeting of directors of the company in Amherst.

Permission has been granted by the state to issue and seli $20,000 in stock. The stock is to be offered at par to the present stockholders in the company the majority of whom are in Lorain.

With the increased capitalization, the company is to rebuild and enlarge its plant.

Three Fairfield county telephone companies were authorized by the public utilities commission to sell additional securities to make possible extensions and improvements.

They are: Carroll Telephone Company, $4,500; Rushville Bell Telephone Company, $2,950; Sugar Grove Telephone Company, $2,600.

The Perry County Telephone Company was permitted to issue $18,850 common stock and $10,000 worth of three-year notes, and the Frazeysburg Bell Telephone Company, to issue $8,400 common stock.

South Dakota

D. W. Dougherty and J. J. Murphy of the state railway commission, O. E. Sweet, attorney for the commission; L. R. Ritney, auditor; and Ivy M. Ash, stenographer, held a hearing on the application of the Webster Telephone Company for permission to increase its rates on rural service on March 8.

Mr. Dougherty, chairman of the commission, conducted the hearing, and after the evidence was taken the hearing adjourned and the commission took the matter under advisement. W. G. Waddell appeared as attorney for the telephone company and there was a large number of the rural patrons of the company present at the hearing.

Chairman P. W. Dougherty and John J. Murphy of Pierre, members of the state railroad commission, were recently in Yankton to investigate the rates being charged by the Yankton Telephone Company. Herman Ellerman of this city had charged the company with exorbitant rates, violating state law, and the session here was for the purpose of taking testimony. The board now has the matter under advisement and further action will develop at Pierre.

Washington

The public service commission hearing in Tacoma to determine the valuation of the Pacific Telephone & Telegraph Company was resumed March 14.

The hearing was delayed while engineers for the commission and for the company could check over their appraisement and reproduction figures, which showed wide variance, and because the commission had a number of other important matters before it for consideration.

Oregon

An amended complaint was filed in the circuit court March 1 in the suit of the city of Woodburn against the public service commission and the Western Telephone Company. The suit is brought to set aside an order of the commission allowing the telephone company to advance its rate and to restrain the company from charging greater rates than those allowed by its franchise.

Vermont

The Bethel Telephone Company, incorporated in 1906 and owned and managed by Carl D. Cushing, has bought the property of the Rapid Telephone Co., owned by M. H. Hazen, South Royalton, and about 60 miles of pole lines of the New England Telephone and Telegraph Company, hitherto leased to Mr. Hazen. Application has been made to the Vermont Public Service Commission for authority to increase the capital stock of the Bethel company from $10,000 to $50,000.

The company has terminal connection with the New England system at Barre and White River Jct. It proposes to make extensive improvements the coming season. C.

Maine

The Public Utilities Commission of Maine has authorized the New England Telephone and Telegraph Company to acquire the stock of the Maine Telephone and Telegraph Company and issue up to 751 shares. The petitioner, the New England Company, already holds 30,668 shares of the Maine Company's stock, and in order to procure the remainder will exchange on the basis of three shares of its own stock for 35 shares of the Maine Company, adjusting the fractional differences on a valuation of $130 for its own stock and $11.14 for that of the Maine Company.

The New England Company proposes to acquire the balance of stock of the Aroostook Telephone and Telegraph Company, exchanging on an equal basis of value. Both companies now pay seven per cent dividends. C.

North Dakota

An order was issued granting to T. Monson of Center a permit to operate a telephone exchange at that city. A similar permit was granted B. S. Wilson to open an exchange at Fort Clark.

The commission decided to hold a hearing at Minot February 10 on the application of the Berthold Farmers' Telephone Company to compel the Northern Telephone Company to make a physical connection with the first named company. This was scheduled to come up before the commission, but was postponed at request of both parties.

Municipal Ownership Question Raised

The committee of the whole of the city council in Los Angeles will consider the general question of municipal ownership of telephones. The East Jefferson Street Improvement Association is interested in the problem and representatives will participate in the conference.

Relative to the possibility of establishing a municipal telephone system, President Fulton Lane of the Board of Public Utilities said:

"The matter is in the wind and some action looking toward acquiring the system of the Sunset Company in Los Angeles may be taken before very long.

"It is well known that the franchise of the Sunset Company will expire this year and that the probabilities are that the city council will not renew that franchise unless the companies agree to provide interchange of service.

"There is no question but that the people generally would like to have a one-telephone system or a municipal telephone system if the latter can be accomplished.

"Recently the matter of municipal ownership has been agitated and a number of people have come to me and talked the matter over.

"A number of local organizations already have declared in favor of a municipal telephone system and suggested an investigation of the wisdom of taking over the Sunset Company's lines.

"I believe the matter could be handled without the city spending much money, except to assume the bonds of the company.

"I doubt very much whether either telephone company would like to sell, but the city through negotiations might be able to make satisfactory arrangements for the purchase of the Sunset system."

The bookkeeper at fifty dollars a month often wonders how the poor laborer at two dollars a day manages to live.

Of Interest to the Trade

What the Telephone and Accessory Manufacturers Are Doing to Advance the Art

New Equipment for Calamus Iowa

The spring construction plans of the Farmers and Business Men's Telephone Company of Calamus, Iowa, includes the installation of a new Central Office equipment to replace the former equipment which is now inadequate to meet the rapidly increasing traffic load.

The accompanying illustration was made from a photograph of the new switchboard taken before shipment from the Stromberg-Carlson Telephone Manufacturing Company's factory at Rochester, New York. The switchboard is wired and cabled for an ultimate

Stromberg-Carlson Switchboard for Calamus, Iowa.

capacity of 100 subscribers' lines and is arranged so that its capacity can be increased to 300 lines if required by the future development of the territory. At present there are 50 lines equipped with plug-restoring drop line equipments, 30 in the first position and 20 in the second position.

Each position is equipped with 15 pairs of cords with double ringing and listening keys. The first 5 pairs of cords in each position to the left of the operator are equipped with repeating coils. Each position is also provided with a master divided circuit ringing key.

The ringing generator equipment includes a pilot lamp mounted in the center of each position above the jack space. This lamp glows brightly when a short circuit or ground on the called line causes an excessive load on the ringing generator. With this equipment the operator can quickly detect any trouble on the various lines.

The contract for the central office equipment includes a terminal frame equipped with heat coil and carbon block protectors.

The Bierce Guy Wire Protector

The Specialty Device Company has recently put upon the market a new device, known as the Bierce guy wire protector, which has been designed specifically for the purpose of protecting the public from the danger of running into exposed guy wires, and is sending out circulars containing a description of the device.

This protector takes the place of pipe, wooden boxes, etc. which have been used in the past, and provides a much more attractive, economical and durable form of protection for guy wires, and it is meeting with a ready reception wherever it has been shown to the trade.

Cumberland Valley to Use Automatic

The Cumberland Valley Telephone Company of Pa. has just completed plans for an extensive rehabilitation and substantial expansion of its system in Harrisburg and Steelton, Pa., and announces that work will begin immediately.

The Cable plant, already extensive, will be increased some 50 per cent, not only enlarging the facilities in the existing conduits, but also extending into new territory, particularly the residential and industrial regions which the growth of the city is opening up.

The present exchange buildings will be slightly remodeled; and full automatic equipment, manufactured by Automatic Electric Company, will be installed in place of the present manual switchboards, which have been outgrown. It is expected that the new system will be in operation by early fall.

The Harrisburg region including Steelton, an industrial suburb some three miles south on the Susquehanna river, is one of the important centers in Pennsylvania, with a population of some 100,000. Besides being the capital of the state, Harrisburg is the center of a large district tributary to it commercially.

The Cumberland Valley Telephone Company of Pa., which operates extensively throughout this section of the state, has exchanges at a number of important points including Harrisburg, Mechanicsburg, Carlisle, Shippensburg, Chambersburg, Gettysburg, Hanover, Pennsylvania; Hagerstown, Md.; Martinsburg, W. Va.; Winchester, Va.; Newport, Miffin, Lewiston, Pa.

In addition to this it operates an extensive toll system covering this entire region and having a total of 600 miles of circuits. The company operates 11,000 telephones located in 32 exchanges.

The Cumberland Valley Company of Pa. was organized in December, 1915, having taken over the Cumberland Valley Telephone Company which was organized

in 1901, and was afterwards a part of American Union Telephone Company system.

Its present officers are: President, Henry M. Tracy; secretary and treasurer, O. K. Kines; general manager, C. L. Baer; directors, Hon. John E. Fox, William J. Lescure, James Brady, Charles A. Kunkel, S. W. Pfoulkes, S. Will Skunkwiler, T. J. O'Neill A. E. Prendergast. The board of directors includes many of the principal bankers and prominent business men in Harrisburg.

The S-R Battery Cut-Out

The S-R automatic battery cut out is a simple device which is designed to save frequent battery renewals in local battery telephone instruments. The increasing price of batteries has caused considerable apprehension on the part of the managers of telephone companies who furnish batteries to their subscribers. The S-R device is designed to offset this growing expense and effect economy for telephone companies who operate party lines.

It is common experience that almost every circuit has one or more persistent "listeners" on the line. They use up a lot of batteries in a relatively short time and with the common equipment there has been really no effective way of stopping the practice. With this device, however, a party line subscriber can listen as heretofore, but his batteries are not in circuit until he desires to talk. Thus the telephone company does not have to pay for his pastime.

The S-R automatic battery cut out consists of an arrangement of contact springs mounted in a small, attractive, oxidized metal case that is screwed on the outside of the telephone under the switch hook. A small rod protrudes from this case and can be moved up and down under the switch hook. The cut out can be used on any standard type of wall set.

When the receiver is on the hook, the rod is pressed down by the switch hook and thereby opens the battery circuit. When the receiver is lifted, the rod remains down, thus keeping the batteries out of circuit. With the receiver up the subscribers can, of course, listen on the line, but they can not talk until the battery circuit is closed by lifting the rod. This may be done with the index finger of the left hand by the same motion with which the receiver is taken off the hook, if an immediate talking connection is desired as, for instance, in answering a call. When listening, to ascertain whether the line is busy or not, the batteries remain out of circuit until the rod is raised. When the talking party hangs up the receiver, the switch hook presses down the rod again and the battery circuit is thereby automatically opened up and remains so until the rod is lifted as just described. Sufficient insulated wire is supplied with the cut out so that it can be connected with the batteries. This, of course, is done in series and is such a simple matter that anyone can easily attach the device.

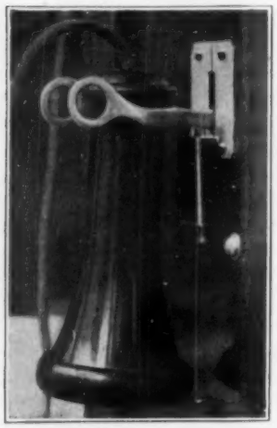
Another important point regarding the S-R battery cut out is the fact that it constitutes an automatic line restorer which is an important part of the S-R private service attachment.

To convert party lines to the S-R private service system it is only necessary to add the S-R "selector" to the telephones equipped with S-R cut outs. To convert the cut out into a line restorer, it is only necessary to invert it, leaving it upside down, so to speak, but attached in the same place on the telephone.

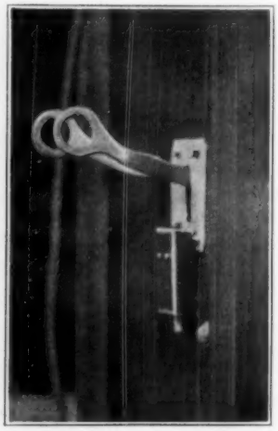
The S-R Electric Company has just completed the installation of fifteen S-R private service attachments on a sixteen-party line at Hillsboro, Wis., for the Hillsboro Telephone Company.

This makes that party line entirely private service, with many other valuable features, as selective ringing either way on the line, great saving in batteries, better transmission, elimination of major portion of cross-talk, etc., etc., as the end instrument does not need the attachment, getting the same private service as the others on the line.

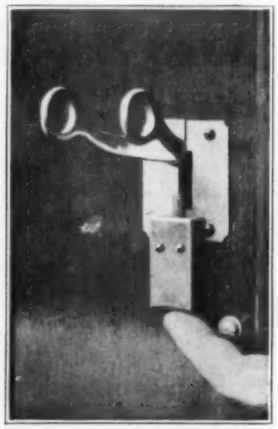
The Wisconsin Telephone Company at Baraboo, Wis. will have three party lines equipped with S-R private service attachments. The Farmers Mutual Telephone Company at Baraboo, Wis. will have these attachments installed on parts of its lines. The several telephone companies at Elroy, Reedsburg, Bangor and Wonewoc, Wis. will be improved by installations in the near future. A party line of the Peoples Mutual Telephone Company of Hillsboro, Ills., which was equipped with private service attachments early in January, 1916, has been in constant service since with the best of results and satisfaction. A recent letter from the Monon & Francesville Telephone Company, which had S-R telephones installed on a party line, states that the telephones work fine and subscribers are well pleased with the operation of the instruments.



Receiver on hook in its Normal Position when Line is Not in Use. Batteries out of circuit.



Receiver off hook. Batteries still out of Circuit While Party Is "Listening in" on Line.



Talking connection made by Pushing Up Rod, Thereby Putting Batteries in Circuit.

Rod Remains in Talking Position Until Batteries Are Automatically Cut Out by Hanging Up the Receiver.

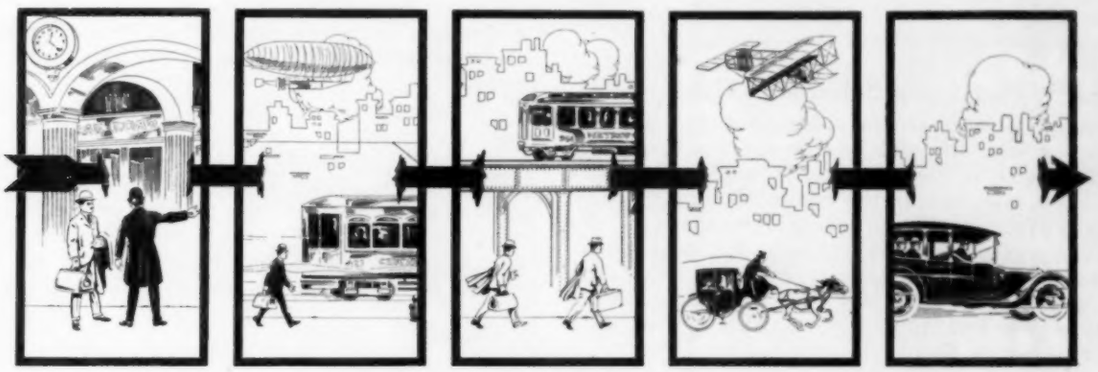
Visit the Kellogg Factory

No independent telephone man who plans stopping in Chicago should fail to visit the big Kellogg factory. This company considers a factory trip, even though brief, the next best way to illustrate the value of Kellogg telephone equipment, the best being to see the telephones and switchboards in actual service.

Therefore, the company offers every inducement and courtesy to the visiting men whose business is to furnish the most important public utility, that they will take the brief time necessary to inspect this immense plant.

One way the company endeavors to make this visit easy is in the distribution of a folder which shows very graphically and very plainly the best ways to reach the plant from "downtown" Chicago. "How to Get There" is a folder, illustrated in colors, showing in pictures as well as telling in type, the easiest ways to Adams and Aberdeen streets, from all parts of the business section.

These "How to Get There" paragraphs are continued on the inside of the folder with a comprehensive



Illustrations from "How to Get There."

map of Chicago's business district and a view of the Kellogg factory with the following significant figures:

"The Kellogg factory occupies an entire block. Floor area, 404,888 square feet. Over 9 acres of floor space.

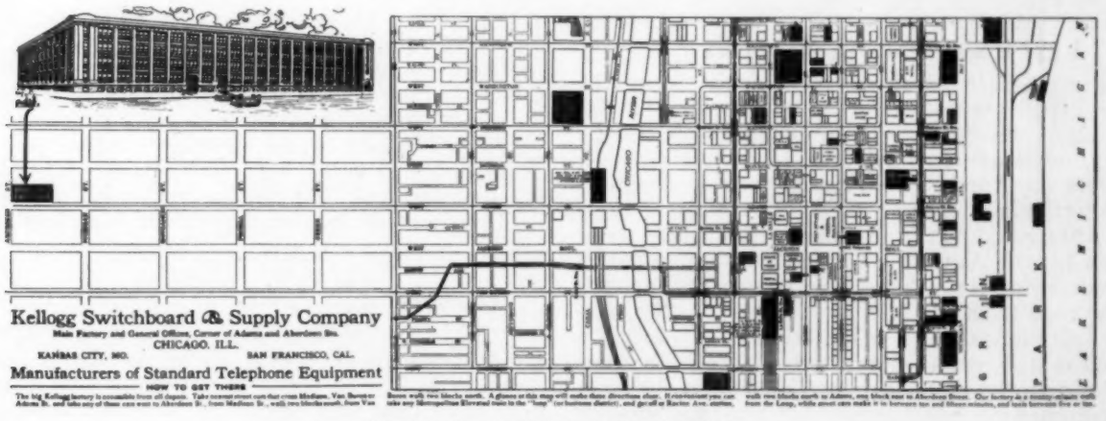
"Kellogg woodworking plant: 12 acres of ground; 8 large manufacturing buildings; 2 warehouses. Floor area, 44,368 square feet. Kellogg equipment also includes a complete dry kiln.

Hubbard's New Catalog

After twelve years of preparation, Hubbard & Company has issued a complete catalog of standard pole line hardware and Peirce specialties. The company has really tried to make this book an encyclopedia of line material, and has, in listing each article, furnished a photograph of the article and as complete a description and table of sizes and dimensions as fifteen years' experience in selling material without a catalog has shown to be necessary. Wherever needed photographs and detail drawings are used showing the way the material is used in actual practice.

The book contains 260 pages, 8½x10 inches, the Electrical Supply Jobbers' Association standard size, and is printed on a suede finish offset paper, which is a great deal easier on the reader's eyes than a coated stock. It has a dark green, flexible paper cover and can be conveniently rolled up and carried about in one's pocket. In fact, from start to finish, this book was obviously designed for practical use, and no pains have been spared to make it useful to the practical man. It does not infringe on the rights of Foster or the Standard by carrying electrical tables, but it will be found to be as much a part of an overhead line construction man's equipment as either of these books.

The 260 pages and 616 illustrations in the book are divided into 16 sections, in each of which material is grouped according to the purpose for which it is used, as, for instance: guying material, crossarms and fittings; high tension arms and fittings; telephone and telegraph wiring; cable material, etc. An abridged



Map Showing the Kellogg Factory Location.

listing of Hubbard shovels and track tools is given, together with a description of the manufacture and use of Bates expanded steel poles. A copy will be sent free to anyone who asks for it. The company has distributed 17,000 of these to the electrical trade and believes that the fact that this is really the first complete catalog of pole line hardware and construction specialties which has ever been issued will create for it an unusual amount of interest.

President May Open Salesman's Congress

President Wilson recently signified his willingness to open the World's Salesmanship Congress which will be held in Detroit, July 9 to 13. He stated to H. W. Ford, president of the Saxon Motor Company and vice-chairman of the program committee of the congress, who made a special trip to Washington to invite him to attend, that he wanted to be at the congress at least one day and that, providing something unforeseen did not prevent him at the last minute, he would be there.

The President, like a great many of the biggest men in this country, realizes that we must be prepared not only in a military way but also in an industrial way. If we are to enjoy the same good share of prosperity that is our portion now that the nations of the old world are at war we must be prepared to fight our industrial and mercantile battles with trained men. We must train our men now while we have the opprtunity and not wait until the war is over when it will be too late.

The object of the World's Salesmanship Congress is to advance the science of salesmanship. Master salesmen from all over the world will be at the congress, the best industrial and mercantile men in this country and Europe will be on the program.

Hugh Chalmers, president of the Chalmers Motor Company and chairman of the program committee is authority for the statement that the progrom of the congress will contain the names of more men of national and international fame than were ever brought together to speak at one gathering.

Line Interference in Nebraska

Twenty-two electrical experts representing the American Telephone and Telegraph Company, the Nebraska Telephone Company, the Lincoln Telephone and Telegraph Company and the University of Nebraska were in Aurora, Neb., recently for the purpose of ascertaining definitely to what extent telephone lines are affected by the transmission line built about a year ago by the Aurora Electric Company between Aurora and Hampton. This line is on the opposite side of the road from the telephone wires and the telephone people opposed its installation vigorously on the ground that it would impair the service. The case was tried out in the district court and before the state railway commission with the result that the electric people were permitted to use the line until its bad effect upon the telephone service was proven. The visiting telephone men subjected it to a number of strong tests and were assisted in every way possible by representatives of the electric company. While they made no public announcement of results, it is believed by those familiar with the situation that they were not as optimistic over the prospect of putting the Hampton line out of business when they left Aurora as when they arrived.

Rochester Employes Get Increases

Nearly one hundred men attached to the construction, maintenance and installation and apparatus and maintenance departments are affected by an advanced wage scale put in operation by the Rochester Telephone Company on March 2. The advance, which was made voluntarily by the telephone company, averages nearly 25 cents a day for each employe. The company has reduced the working day from nine to eight hours.

President George R. Fuller said the advanced wage scale had no connection with the recent unsuccessful strike of employes attached to Local 44, Electrical Workers of America. "That is a closed incident, and has no bearing on the present action of the company," he said. "It has been our policy always to advance the wage rate as fast as conditions warrant. Conditions now seem to warrant it, hence the advance."

Consolidating Bell and Federal Telephones

In an interview with B. G. Hubbell of Buffalo, president of the Federal Telephone Company, it has been learned that there will be consolidated a number of plants of the Federal Telephone Company and Bell company in Western New York. This will apply particularly with cortland and Penn Yan. Later on it may also apply to Medina and Geneva. Mr. Hubbell has issued a statement in which he says: "This will be a beneficial feature for the long distance user. Although the telephone service in this village will be strictly a Federal service, and the service in Cortland will be Bell, the long distance lines of these two companies will trunk into each other, thus giving every large city subscriber a possible connection with every telephone user in Cortland and Penn Yan."

The Bell interests own practically all of the telephones in use in Medina, while the Federal own practically all of the telephones in Geneva. It is said by telephone officials that the reason for consolidation is a matter of economy for both telephone interests and subscribers. Where a company is greatly in the minimum in the number of subscribers, it is only a matter of expense to continue the operation of such a plant. The subscriber does not, on the other hand, receive as much value for his money when the number of telephones in his respective town is limited.

Mr. Hubbell stated that the matter of further consolidation is now before the Department of Justice in Washington, and that no further action will be taken until the approval of that department is secured.

Organizing Independent Company in Utah

Initial proceedings in the organization of an Independent telephone company for service in Salt Lake county, Utah, were begun at a meeting held in the office of County Commissioner C. F. Stillman, March 2.

The telephone controversy at Wathena, Kansas, has now reached the point where the backers of a mutual company have discharged their committee appointed to treat with the Northeast Kansas Telephone Company and have gone ahead in their arrangements for a new company by adopting a constitution and by-laws and electing officers and directors. The new company is to be capitalized at $15,000 and divided into 300 shares of $50 each.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

PERSONAL NOTES.

A. von Schlegell, for several years general manager of the Michigan State Telephone Company, has resigned that position and been made vice president of that company. Mr. von Schlegell will hereafter be actively engaged in the executive and managerial work of the Hupp Motor Car Corporation, of which he has become vice president. He has

G. M. Welch succeeds Mr. von Schlegell as general manager of the Michigan State Telephone Company and will assume active charge. Mr. Welch was commercial superintendent for several years.

A. von Schlegell becomes vice-president of the Michigan State Telephone Company and also vice-president of the Hupp Motor Car Company and will devote a large part of his time to the Motor company's business.

for the past 21 years been active with the Bell system in the northwest and Chicago, and as general manager of the Michigan State Telephone Company. G. M. Welch, commercial superintendent of the Michigan State Telephone Company, has succeeded Mr. von Schlegell as active head of that company.

Frank T. Lathrop, telephone expert of the state public service commission, Jefferson City, Missouri, has resigned to accept a position with a southern utility company. George P. Player of St. Louis has been appointed his successor.

Henry W. Pope, a well-known old-time telegrapher and telephone man, died at his home in Bellerose, Long Island, N. Y., February 29. The deceased was sixty-eight years old and one of the chief organizers of the Telephone Pioneers of America and was its secretary until last year, when he resigned on account of ill health. Mr. Pope filled various positions with different interests. His remains was interred in the family lot in Mahaiwe cemetery, in Great Barrington, Mass., his old home.

George C. Sutherland, who has been with the auditing department of the Nebraska Telephone Company in Omaha for several years, has been transferred to the engineering department of the Bell Company at Minneapolis.

Dr. J. Zenneck, professor of physics at the Technical High School of Munich, Germany, spent several days in Lancaster, Pennsylvania, conducting investigations and tests upon a new system for radio telegraphy and telephony, developed by the McCaa Radio Company. Doctor Zenneck has been in this country for some time past, acting as an expert for the Telephone Wireless Company, and is recognized as one of the foremost authorities on the wireless art.

R. B. Cochran, district agent of the Bell Telephone Company in Hutchinson, Kansas, has been made a director of the Southwest Kansas Long Distance Telephone & Telegraph Company, operating along the Rock from Hutchinson to Meade, with side lines.

John Seegars, while trying to thaw off the lid of a manhole of a Citizens' telephone conduit on Jackson street, Mankato, Minnesota, escaped with slight injuries when an explosion caused by the liquid leaking down through the lid and forming a gas threw him several feet away.

Robert D. Fuller of the commercial department of the Worcester exchange of the New England Telephone & Telegraph Company at Massachusetts has been appointed manager of the exchange at Great Barrington.

A. von Schlegell, for several years general manager of the Michigan State Telephone Company at Detroit, has resigned to accept a position with the Hupp Motor Car Corporation. He is succeeded by G. M. Welsch, commercial superintendent.

P. J. Wierich, general manager of the United Telephone Company in Monroe, Wisconsin, and John H. Wright, general manager of the Home Telephone Company at Jamestown, New York, paid a visit to the office of TELEPHONE ENGINEER.

NEWS FROM THE FIELD.

ARKANSAS.

March 1, G. H. Blankenship took charge of the Quitman telephone exchange which he recently purchased from J. B. Jackson.

A new line from Arkadelphia to Hot Springs has been built by the Southwestern Telephone Company and many of the farmers have taken connections.

A rural line has also been completed by the farmers who reside on or near the Confederate road, under the direction of James A. Dickson and John A. Wilson. It is ready for connection with the Little Rock exchange of the Southwestern Telegraph and Telephone Company. The line is owned by the Community Company, of which Joe P. Wright is president and John M. Dixon is secretary-treasurer.

The cable and wires of the Lonoke Telephone Company were damaged to the extent of $250 by a fire which destroyed the T. T. Goodrum & Brothers building in Lonoke.

CALIFORNIA.

Preparations are being made by the Pacific Telephone and Telegraph Company to spend a large sum of money in enlarging its system in Richmond.

COLORADO.

Material for the construction of the telephone line from Genoa to Burlington and for the exchange which is to be installed at Flagler by the Mountain States Telephone and Telegraph Company is arriving and work will be started at once.

Over 200 telephone and telegraph poles were blown down in a recent wind storm between Kilker and Fountain. The Mountain States Telephone and Telegraph Company rushed an emergency force of workmen to the scene and communication was established.

ILLINOIS.

The Chicago Telephone Company has completed plans for the erection of the new South Chicago telephone exchange to be located at 2652-64 East Eighty-ninth street. The new structure will be a three-story brick and most modern, costing $87,000. Permit has been granted and ground will be broken in a very short time.

The wires of The Chicago Telephone Company and the Western United Gas and Electric Company will be run in conduits in the main street of Glen Ellyn.

The DeKalb County Telephone Company reports a very favorable year.

Blue Mound Telephone Company, Blue Mound; $20,000—To operate one or more telephone exchanges or plants. Albert W. McClure, Addye J. McClure and James A. McClure.

When the new directory of the Central Union Telephone Company in Rockford is issued, subscribers will find that it contains the new prefix Forest, the adoption of which is made necessary by all the numbers in the Main switchboard being in use.

At the annual meeting of the Vermilion County Telephone Company, Danville, March 1, officers for the ensuing year were elected as follows: President, S. F. Phillips; secretary and general manager, R. C. Rottger; treasurer, C. P. Nelson. On account of the serious illness during the past

sixty days of J. H. Davis, who has served the company as president and manager since its organization, made a change in the management necessary at this time pending his recovery.

Monmouth is installing the automatic telephone system.

The new directories for the Kewanee Home Telephone Company are being distributed.

Chatsworth Telephone Exchange, Chatsworth; capital, $20,000. Incorporators, Leo F. Garrity, James W. Garrity, Frank Murtaugh.

Fisher Telephone Company, Fisher; capital stock increase from $10,000 to $11,000.

Fritz Stueland, Henry Johnson and Clifford Anderson are engaged in preparing the telephone poles for the Gibson City trunk line installation. The Dix Company will construct half of the line and the Gibson Company the other half.

Altona Farmers' Telephone Company, Altona; $2,500—To do a general telephone business. D. M. McMaster, Gust Bjorling, A. A. Hager, C. A. Ebstedt, S. B. Brown and J. W. McQueen.

Pearl City Mutual Telephone Company, Pearl City; capital, $5,005; incorporators, Edward Follmeier, Lewis H. Kuhlmyer, Louis C. House, D. F. Thompson, J. G. Woker.

INDIANA.

The Rotary club were guests at the new plant of the Southern Telephone Company on Sycamore street, Evansville, on the afternoon of February 29. Hundreds of visitors also inspected the commodious and elaborately fitted out home and were served refreshments.

Everything is in readiness to begin the $40,000 improvement to the plant of the Central Union Telephone Company in Bloomington.

Cloverdale Telephone Company, Cloverdale; capital, $5,000; to operate telephones, telephone lines and exchanges; directors, Robert L. Job, Arthur Miles, William P. Furr, Jesse E. McCoy.

Officers and directors of the Home Telephone Company, Richmond, renamed for the ensuing year at a recent meeting, are John M. Lontz, president; E. H. Cates, vice president; L. E. Browne, secretary and treasurer; P. J. Freeman, attorney, and William M. Bailey, general manager. Directors are the foregoing officers and S. W. Gaar, E. G. Hibberd, P. W. Smith, A. C. Lindemuth, all of Richmond; H. C. Starr of Indianapolis, L. M. Flesh, S. K. Statler, W. A. Snyder and J. L. Boyer, all of Piqua.

The work of installing the new switchboard at the south side branch of the Home Telephone and Telegraph Company, Fort Wayne, is progressing rapidly and it will be in service within the next four weeks, according to an announcement made by assistant manager Frank Bohn.

Stockholders of the new Cloverdale Telephone Company, which was recently organized to purchase the plant that has been operated by Charles Tribby, held a meeting February 26 and elected a board of directors for the organization. Besides the stockholders a large numer of citizens of south Putnam county were present. Members of the new board of directors who were chosen are Jess McCoy, W. E. Gill and W. S. Burris of Cloverdale; Lee Job, William Furr, Arthur Miles and Sterling McCammack. According to a report of the directors, the new company will be incorporated at $5,000. More than $4,000 of stock has already been sold. The plant was purchased for $3,500.

A new farmers' line with eight suscribers has just been connected with the Sellersurg exchange of the Southern Telephone Company of Indiana. The line extends four miles out the Henryville pike and furnishes service to suscribers at Perry Station.

IOWA.

The Center Grove Telephone Company, with headquarters in Durant, has been incorporated at Muscatine. The new rural telephone company will have no capital stock but each telephone instrument owner will be considered a member of the corporation. The officers are: Henry Nitz, president; John Paustian, vice president; Fred Bockwoldt, secretary-treasurer; B. P. Otto, trustee for one year; William Untiedt, trustee for two years; Charles Bockwoldt, trustee for three years.

Telephone operators in northwest Iowa are to be given the benefit of instructions by the engineering department of the state college at Ames, a short course having been scheduled for LeMars for March 30 and 31.

Patrons of the Appanoos County Telephone Company are enjoying the new system which was recently installed.

At the annual business meeting of the Farmers' Mutual Telephone Company, held at College Springs, it was decided to purchase a new switchboard.

The special election held in New Hampton March 14 to decide upon the granting of a franchise to the Hurmence Telephone Company of Sumner resulted in the favor of the measure with 215 votes for it and 27 against it. The ringing system will be changed from the old-fashioned battery to the modern method of central control.

The Iowa Telephone Company has put into service its new five position switchboard at Audubon.

The Engineering extension department at Iowa State College will conduct an operators' school at Centerville, March 23-24; Le Mars, March 28-29, and Manning, March 30 and 31.

KANSAS.

Stockholders of the Jewell County Mutual Telephone Company, Mankato, held their annual meeting and election February 26. Carl Cederberg was elected president; L. H. Cauthorn, secretary-treasurer, and C. E. Sweet, John Hanna, Alva Swope, John Stevenson and George E. Holdren were elected directors.

Elmont Telephone Company, Elmont, Shawnee county; capital, $10,000.

The Bell Telephone Company recently closed a deal by which they acquired the Hays Telephone System and also the Stockton line.

Because of continued increase in business the Sabetha Mutual Telephone Company has asked for bids on a new 1,200 phone switchboard. The old switchboard, which accommodates 800 phones, is too small for the company's purposes. The new switchboard will cost about $5,000.

In order to better guard its pipe line between Bartlesville, Okla., and the oil fields of Augusta, the Wichita Natural Gas Company is going to construct a private telephone line over the route of the pipe line. Officials of the company believe the telephone line will aid materially in locating accurately and speedily all breaks and will prove of great value during cold weather when breaks are more likely. Clarence Shortess, who has charge of constructing the new telephone service, was in Wichita to arrange for purchase of construction material.

KENTUCKY.

The Red River Gillmore Telephone Company, Hazelgreen; capital, $150; incorporators, L. E. Smith, J. L. Fallen and A. J. Lindon.

Ezel & White Settlement Telephone Company, Pine Grove; capital, $350; incorporators, W. D. McClure, J. C. Lane and L. G. Murphy.

Vine Grove Telephone Company, Vine Grove; capital, $1,000; incorporators, R. L. Buchanan, G. L. Cruse and W. W. Vertress.

MICHIGAN.

Almont Telephone Company, Almont; $15,000.

Directors were elected for the year at the annual meeting of the stockholders of the Citizens' Telephone Company of Battle Creek. Those who were named were C. E. Tarte, L. McCoy, W. S. Keet, R. W. Synder, C. E. Perkins, F. W. Clapp, G. B. Martin, R. D. Graham, P. B. Garvey. The directors will elect officers for the year at a later meeting, the date of which has not yet been announced.

The Blanchard Telephone Company was sold February 29 to John McDonald and J. E. Adams, both of Blanchard. The system consists of 200 telephones, sixty miles of poles and 250 miles of wire. The new company will begin work at once, restoring the line, and putting it in up-to-date condition. The lines connect with the Citizens and the Bell companies.

MINNESOTA.

The second annual banquet of the Zenith Telephone Company was enjoyed by one hundred and fifty "hello" girls, office clerks and other employes.

M. L. Lane of Minneapolis, general commercial superintendent, and E. Lister of Duluth, district manager of the Northwestern Telephone Company, met with the Bemidji Merchants' association at the Commercial club rooms and discussed a reduction in telephone rentals for Bemidji. Mr. Lane stated that a city the size of Bemidji should have about 2,400 telephones while it now only has 900 telephones. As soon as the 1,500 number is reached a change in rates may be made.

On account of the rapid growth of Rochester, it has become necessary for the Rochester Telephone Company to rearrange and regroup their distribution of cable conductors so as to increase their facilities in certain congested districts.

MISSOURI.

J. M. Freshwater, who recently sold the light and telephone system in Shelbyville to James Edelen & Company,

has purchased the telephone exchange at Hunnewell and took possession March 1.

NEBRASKA.

The Lincoln Telephone & Telegraph Company has paid the city of Lincoln $299.45 as an occupation tax for February. This represents 1 per cent of the company's receipts of $29,945.07 for the month.

The annual stockholders' meeting of the Falls City Telephone Company was recently held in the office of the First National bank. A board of directors was elected for the year, consisting of A. J. Weaver, J. H. Miles, W. E. Dorrington, T. J. Gist, A. W. Loucks, J. F. Frederick and E. H. Towle.

The Nebraska Telephone Company has completed a new toll line from Ogalalla to Grant.

A mortgage for $10,000,000, given by the Lincoln Telephone & Telegraph Company to the Harris Trust & Savings Bank, of Chicago, has been filed in County Clerk Wells' office. The company gave the mortgage to secure papments on a like amount of first year, 30-year gold bonds, issued in denominations of $500 and $1,000.

NORTH CAROLINA.

The Home Telephone and Telegraph Company has recently put into operation their new line between Goldsboro and New Bern.

NORTH DAKOTA.

Connections were being made March 1 between the Northern and Berthold Farmers' Telephone Companies, in Ward county. This settlement is the result of several years' litigation in the courts.

The farmers of West Brittain township, near Mott, have just organized a new telephone company.

An important meeting of the shareholders of the Oliver Mercer Telephone Company was held in Center March 13, and attended by a large majority of patrons. The election of new officers resulted as follows: President, H. O. Monson; Secretary, I. O. Lee; Treasurer, H. J. Schulte; Director, north line, Joe Novak; Director, Stanton, Stephen Brown.

The telephone exchange at Scranton was slightly damaged by fire.

For some time past a telephone line has been needed west and north of Sarles and several interested parties held a meeting in this village and a large attendance was present. It was decided to organize and the company will incorporate under the name of The Smith Telephone Company. The following were elected to the board of directors: J. E. Barker, F. J. Martz, Martin Estenson, C. C. Sprinkell and A. C. Buhcolz. F. C. Leppert was elected secretary and treasurer. The proposed line will cover twenty-three miles.

The Sunny Center Telephone Company held its annual business meeting at Stanley. There were no changes made in the list of officers with the exception of the election of Matt Nordlum as one of the directors to take the place of Gunder Enge. Following are the directors and officers who will serve this year: Directors, Alfred Peterson, A. D. Pierce and Matt Nordlum; President, A. W. Dubois; vice-president, G. F. Wanke; treasurer, Martin Holter; secretary, Wm. P. Reycraft.

Farmers at Leith have incorporated and launched a new telephone company which will run a trunk line from Leith to Miner and serve other districts through branch lines.

Con Short, John Leaky and Geo. Gardner, three prominent ranchers in Billings county along the Little Missouri river, held a conference in Dickinson with Mr. Doolittle of Billings, president of the telephone company which operates at Medora, as to the possibility of securing the construction of a telephone line from Medora up along the river about thirty miles. The matter was not decided.

The farmers of West Brittain township, near Mott, have just organized a new telephone company.

OKLAHOMA.

The Pioneer Telephone Company of Oklahoma City will enlarge its property holdings in Shawnee by the construction of a $100,000 office and exchange building. The company will occupy the entire building, with the exception of a few office rooms which will be for rent. It is expected the building will be ready for occupancy in the early fall.

The Pioneer Telephone and Telegraph Company have distributed their new Oklahoma City directories. Five hundred and forty new names are listed in this issue, a gain of ten per cent for the period of four months.

OREGON.

E. S. Jenne, of Gresham, and Robert Jonscud, of Kelso, were elected directors for the Multnomoh & Clackamas County Mutual Telephone Company for a term of five years at a meeting held in Gresham.

PENNSYLVANIA.

An exceptionally enthusiastic conference and smoker of all Bell telephone salesmen in the Reading, Lebanon and Pottsville districts was recently held in the offices of the company on North Fifth street, Reading. The conference proved of such interest and so much benefit was derived therefrom that it was planned to hold them at frequent intervals in the future.

The operators of the Consolidated Telephone exchange at Carbondale held a banquet at Bronson lodge, Washington street, February 29.

Plans are being made for a new building for the Bell Telephone Company at Pottstown.

The Bell Telephone Company of Reading has just completed the delivery of the spring issue of its telephone directory. This new book is of attractive appearance and shows a substantial increase in the list of Bell subscribers.

The annual meeting of the Manatawny Rural Telephone Company was held at the Yellow House hotel, Yellow House. The following officers were re-elected: President, George H. Schearer, Amityville; vice-president,, John R. Guldin, Yellow House; secretary, W. D. Reeser, Yellow House, and treasurer, M. E. Weidner, Earlville. These directors were also re-elected: Llewellyn Leinbach, Yellow House; George B. Greisemer, Pleasantville; H. D. Renninger, Pikeville; M. H. Kline, Earlville, and John M. Schearer, Yellow House.

S. G. Smead, local manager of the Bell Telephone Company of Pennsylvania, states that there has been a net gain of 255 stations on the Williamsport exchange during the past year, making a total to January 1, 1916, of 3,930 subscribers who are being served from the Williamsport central office.

Reorganization of the Cumberland Valley Telephone Company, the independent line operating in the Cumberland Valley, has been effected by the bondholders, who purchased the company at receiver's sale November 5 to protect their interests. The new officers are: Henry M. Tracy, Doylestown, president; W. J. Lescure, vice-president; Oscar K. Kines, secretary-treasurer; directors, James Brady, Charles A. Kunkel, John E. Fox Messrs, Tracy and Lescure, Thomas J. O'Neill, Hanover; T. E. Pendergast, Trenton; S. W. Foulkes, Philadelphia;, and H. W. Shunkweirer, Lewistown. New capital stock to the amount of $750,000 has been subscribed by the new directors. It is the intention of the new management to place the company on a thoroughly efficient basis. The annual election of the stockholders will be held the first Monday in May.

A plot of land for the erection of a new telephone exchange, located at the corner of Division street and Wyoming avenue, Kingston, was purchased from the Pringle estate by the Bell Telephone Company. Plans for the building have been started by the engineering department of the company and it is expected that the actual work of construction will be started within a few months.

The Bell and Consolidated Telephone Companies are repairing their lines in Griesemersville.

The Princetown Rural Telephone Company, Princetown, elected officers for the ensuing year as follows: President, S. J. Hill; secretary, D. H. Manwiller; treasurer, Daniel Buskirk. The other members are G. W. Brown and W. H. Noll.

The annual meeting of the stockholders of the Petroleum Telephone Company was held at the Reed house in Erie on January 19. Announcement was made that the company is now contemplating extensive improvements to be made in the vicinity of Oil City. Fred N. Chambers, Oil City, was elected a member of the board of directors to fill the vacancy caused by the death of Mr. Hayes, and the other members of the board were re-elected. They are: W. A. McMaster, Jamestown; Hon. P. M. Speer, Oil City; Axtell J. Byles, Titusville; George B. Kalb, Erie; W. S. Paca and R. G. Lamberton, Oil City. The officers elected are: President, Hon. P. M. Speer, Oil City; vice-president, George B. Kalb, Erie; treasurer, C. M. Lamberton, Oil City; secretary and general manager, W. S. Paca, Oil City.

SOUTH DAKOTA.

Articles of incorporation have been filed for the Moe Telephone Company, in Norway township, Lincoln county, with a capital of $1,000. The incorporators, Ole Nordlie, Charley Eckley, John J. Sheenland, of Hudson.

Business men of Morristown, co-operating with the farmers of Custer and Pioneer neighborhoods, are forming a company to promote a rural telephone line which will be constructed soon.

March 6 several of the farmers living southwest of Greg-

ory met and organized a telephone company and have opened negotiations with the Nebraska Telephone Company to purchase their line running in that direction. The line will be extended and about fifteen or twenty phones added to the Gregory exchange. The officers elected at this meeting are as follows: President, M. Weiand; secretary, Lee McKimm; treasurer, Erwin Dossow; lineman, George Anderson.

At the telephone meeting of the Day township line it was decided to make a change in the service at the Stevens switch. Hereafter parties having phones on Line 11, Henry Union, may have the use of the Day line and the switch at Clark. The Day line will have the use of Line 11, but cannot go beyond the switch at Clark. All other lines of the Henry union can use the Day line except the Clark switch. For several years the Henry union has allowed the Day township patrons the free use of their 170 miles of line in exchange for their 6 miles.

TENNESSEE.

The farmers' independent telephone lines in Newbern have been completed throughout the country district. Communications can now be had over the county.

The offices of the accounting department of the Cumberland Telephone Company in Nashville were destroyed by fire January 4, with a loss of about $25,000. The origin of the fire was unknown. Service was interrupted for about an hour.

TEXAS.

A three-story exchange building will be erected by the San Angelo Telephone Company.

The Tri-State Telephone Company will soon begin an addition to its present building at Florence and Texas streets, El Paso, to cost $30,000. The addition will be 42x120 feet, two stories in height and built in the rear of the present building. It will provide space for a large operating room, a school of instruction for operators, and a rest room.

UTAH.

The Mountain States Telephone and Telegraph Company has a force of men in Hyrum improving its lines. They will discontinue the exchange at Wellsville, it is said, and connect it with the Hyrum exchange. This will put the towns of Hyrum, Wellsville, Paradise, Avon and the rural district of Mt. Sterling on the local exchange.

VERMONT.

The Bethel Telephone Company, owned and managed by Carl D. Cushing, has purchased the property of the Rapid Telephone Company, owned by M. H. Hazen of South Royalton, and about 60 miles of pole lines belonging to the New England Telephone Company, hitherto leased by Mr. Hazen. The result will be the consolidation of the Hazen and Cushing systems and the elimination of much duplication in telephone patronage by the consolidation.

WASHINGTON.

F. C. Babcock has purchesed the city telephone system of Fairfield and is installing a new switchboard to connect with the farmers' and with the long-distance lines. Temporary offices are being arranged in front of the Moss billiard hall.

The Pacific Telephone & Telegraph Company in Seattle have eliminated all numbers higher than 8000. The changes are a matter of efficiency, according to the company. On the switchboards the telephone girls must reach high above their heads to connect numbers above 8,000. The reduction and consequent grouping of the numbers will make their work easier and enable them to make connections more promptly.

The Pacific Telephone & Telegraph Company and the Portland Railway, Light & Power Company are making every effort to restore their lines to normal in Vancouver.

Puget Sound Telephone Company, Everett; capital stock, $200,000; W. N. Winter, Hood River, Ore.; J. M. Winston, Seattle, and W. C. Cox, Everett.

Cloverleaf Telephone Company, Pullman, $10,000, Andy Meal, J. W. Darland, P. M. Long.

The Independent Telephone Company, operating an extensive system of rural lines southeast of Chehalis, has decided to sell its Chehalis-Ethel, Chehalis-Toledo, Toledo-Winlock and Toledo-Ethel lines. The Farmers' Independent Telephone association of Salkum has decided to dissolve and arrangements for that end are under way.

The Home Telephone Company, in Winlock, which has nearly 400 phones in the city and on rural lines operating out of here, has chosen the following officers: F. H. Crosby, president; F. C. Schaefer, vice-president; A. C. Shives, secretary and treasurer.

Puget Sound Telephone Company, the new firm recently organized to take over Puget Sound Independent Telephone Company and Pacific States Telephone & Telegraph Company exchanges in the northwestern part of this state, took charge of the Independent company's business in Mt. Vernon on March 1. It is expected that the new company will take over the Sunset business about April 1. Just how soon the two local exchanges will be combined is not known.

WISCONSIN.

Farmers of Nekoosa have organized a new telephone company to be known as the Lynn Creek Telephone Company and will connect with the Wood Telephone Company lines at Nekoosa.

The Saxon Telephone Company, Saxon; capital, $3,000; incorporators: E. S. Murrell, Mayme Young and Louis Charron.

At a meeting of the Skillet Falls Telephone Company it was decided to incorporate, with the following board of directors: Wilbur Cahoon, Dwight Welch, A. K. Bassett, Wm. Zantow and W. Ryan. The directors elected the following officers: President, Wilbur Cahoon; vice-president, Dwight Welch; secretary and treasurer, A. K. Bassett.

The Annaton-Preston Telephone Company will very shortly install a new switchboard at Montfort.

The new exchange of the Wisconsin Telephone Company at Superior will be completed soon.

Articles of incorporation have been filed by the Big Suamico Telephone Company, organized to operate a telephone system in Brown and Oconto counties. It is proposed to construct a line between Suamico and Green Bay. Lines to the bay shore and into Oconto county may be built also. The capital stock of the company is $1,000. Charles Tuttle, Earl C. Clewley and Charles R. Swanson, prominent men of the town, are the incorporators.

The new Orchard exchange of the Wisconsin Telephone Company was put into service February 26.

The lines of the Oconto Rural Telephone Company, about seven miles of which were destroyed by the sleet storm last month, have been rebuilt and the patrons are again receiving uninterrupted service. The loss to the company was considerable.

The Washington County Telephone Company, at a stockholders' meeting held recently in Schleisingerville, raised the rates on nearly all the private lines controlled by them twenty-five per cent.

Trego Telephone Company, Trego; capital, $5,000; incorporators, W. A. and A. E. Porter and G. H. Ross.

The Wisconsin Telephone Company will replace the main exchange building in Milwaukee with an eight-story structure to cost more than $1,000,000. The building will have a frontage of 120 feet on Broadway and will include the present site at 424 Broadway and extend to the Miller building, replacing the old Nixdorf hotel property. H. O. Seymour states that the building plans now are in the hands of architects.

The annual plant meetings of the plant men of the Wisconsin Telephone Company are now being held in different parts of the state. The object of the meetings is to discuss the various methods of telephone plant repairs and construction work in order to keep the exchanges at all times up to top-notch efficiency. The first meeting was held in Eau Claire, January 18.

The Wisconsin Telephone Company's construction crew is now nearing the completion of the new line between Eau Claire and Chippewa Falls. A large construction force has been started on extensions and additions to the plant at Menomonie, which will involve an expenditure of something over $29,000. At Superior a large force of men is at work on the rebuilding of the plant there. A new building has been erected and is practically completed at a cost of $45,000. The improvements there will include underground work and will mean an expenditure of over $150,000.

The annual meeting of the stockholders of the Tenney Telephone Company, Alma, was held and the following were elected to office: Dr. J. S. Tenney was elected president and the other officers were re-elected: J. A. Ganz, vice-president; August Hitt, secretary, and T. S. Saby, treasurer. Directors elected are as follows: J. G. Bates, Jacob Braem, A. C. Brinkman, Peter Wald, Benedict Kindschy, Andrew Thompson, Fred Ristow and Frank Holthaus.

The Wisconsin Telephone Company has approved an estimate of $60,000 for the placing of wires of the company under ground in the business district of Kenosha. According to an ordinance passed by the Kenosha council all wires must be under ground not later than July 1.